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THESIS

JUST-IN-TIME INVENTORY MANAGEMENT;
APPLICATION AND RECOMMENDATIONS FOR
NAVAL HOSPITAL, OAKLAND

by

Bill C. Kinney
and
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December, 1992

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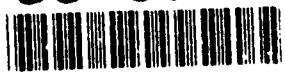

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With diminishing budgets, material managers must adopt innovative practices that reduce resource requirements, while providing high quality care. JIT is an innovative approach to inventory management that has been successfully applied in the healthcare industry. The authors examine JIT and how this philosophy can further the goals of the prime vendor program and increase quality of care.

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Just-in-Time Inventory Management;
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for Naval Hospital, Oakland

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ABSTRACT

The purpose of this research was to provide recommendations to personnel at Naval Hospital, Oakland, in examining the applicability of a Just-in-Time (JIT) inventory management system. JIT is a philosophy that can be applied to inventory management operations to reduce waste, achieve cost savings, maximize space, and improve quality of care. In the healthcare environment, a prime vendor program is essential to a successful JIT program. With the advent of a prime vendor program at Naval Hospital, Oakland, the advantages offered by JIT become available.

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I. INTRODUCTION

A. RESEARCH INTENT

In recent years, some hospital materials managers have been instrumental in reducing overall operating costs, resulting in increased cash flow to the organization. [Ref. 1:p. 8-12] This has been primarily accomplished through innovative techniques aimed at the elimination of "excess" hospital inventories. These material professionals have capitalized on Just-in-Time (JIT) inventory management techniques that reduce inventories and dramatically improve product quality through the elimination of "wasteful" activities. These wasteful activities, such as long procurement leadtimes and excessive safety stocks, contribute to high inventory levels, increased product costs, and reduction of product quality.

Commencing in March 1993, an inventory reduction program, referred to as prime vendor (PV), will be available to the Department of Defense (DoD) medical treatment facilities on the west coast. This Just-in-Time related program will offer a radically new approach to the procurement and management of medical/surgical and pharmaceutical supplies. Through the PV program many of material logistic functions will be transferred from the hospital to the PV. The main goal of the Defense Personnel Support Center (DPSC) in instituting the PV

program is to reduce the hospital's overall delivered cost for brand name medical supplies. This will be accomplished as follows: [Ref. 2:p. 2]

1. Reduction in stock levels.
2. Reduction in losses caused by expirations and overstocking.
3. Reduction in manpower.
4. Use of existing industry automation to expedite order processing to the prime vendor.

The intent of this research is to present the JIT inventory management philosophy and demonstrate how the goals of the PV program can be enhanced using a JIT system. In order to maximize these goals, more must be done than simply transferring functions to the PV; the JIT philosophy must be adopted in daily operations. Naval Hospital, Oakland, is one of the activities that can benefit from prime vendor and JIT to further improve existing inventory operations. The authors have gained the approval of the Commanding Officer, Naval Hospital, Oakland, to research the JIT concept and associated practices, and offer specific recommendations that are crucial in attaining the benefits obtained from a JIT inventory system. The detailed planning and implementation of specific JIT techniques are left to the expertise of the materials managers at that hospital.

B. BACKGROUND

How to deliver cost effective and efficient healthcare is one of the most perplexing and widely debated social issues of the 1990s. This concern applies

equally well to the military and private healthcare delivery systems. From 1980 to 1990, annual private healthcare expenditures increased, on average, 11.6%. [Ref. 3:p. 1] During this same period, DoD healthcare expenditures increased an average of over 20% annually. [Ref. 4:p. 1][1] As we approach the twenty-first century, cost containment will be the critical watchword in public and private sector healthcare.

During the past decade healthcare professionals, members of government, and consumer groups, have sparked intense debate on how to curb rising healthcare costs. Efforts at controlling costs are focused in every aspect of medical care. With approximately 33% of every healthcare dollar allocated to logistics-related costs [Ref. 5:p. 18], this area promises to be a lucrative field in achieving significant cost reductions. Savings can accrue through innovative practices inherent to a JIT system. These include: streamlining procurement procedures, establishing closer relationships with suppliers, developing more reliable transportation methods, decreasing space dedicated to inventory storage, and integrating information systems.

A December 1991 GAO report critical of high DoD medical inventories recommends that the services adopt inventory management initiatives similar to

[1] It should be noted that the percent increases between the private sector and DoD cannot be compared to one another. These figures are provided to illustrate the dramatic rise of health care costs.

those implemented at Vanderbilt University Medical Center (VUMC) and the Veterans Administration (VA). [Ref. 6:p. 3] Specifically, the study cites the use of Just-in-Time inventory techniques, primarily prime vendor contracting, at the two facilities. The use of JIT inventory practices in these hospitals has proven extremely successful in reducing inventory levels, and subsequently costs. Navy medicine must fully exploit similar practices that prove to be consistent with mission requirements and are responsive to the healthcare needs of its beneficiaries.

Any efforts to mirror civilian or VA practices in military medicine must be exercised with caution. We must ensure that the initiatives chosen complement the high standards of medical care enjoyed by Navy medicine, and maintain a high state of medical readiness. The authors believe that JIT concepts can benefit inventory management operations at Naval Hospital, Oakland. However, careful scrutiny of JIT is essential to ensure that this philosophy will render beneficial results in the military environment.

C. JIT AND PRIME VENDOR CONTRACTING

It is important to make a distinction between JIT and prime vendor contracting at the onset. JIT is a philosophy focusing on improving product quality through the elimination of waste in a production environment. Applying this philosophy to inventory management results in reduced inventory levels and subsequently costs. Current literature is replete with discussions and definitions

of JIT, but is not consistent. In its purest meaning, JIT requires "...having the right material arrive at precisely the time it is needed by the user." [Ref. 7:p. 528] In inventory management, this is accomplished by decreasing variability in leadtimes of purchased material, set-up reductions, and streamlined ordering processes.

Prime vendor contracting is a method under the JIT umbrella that, if implemented properly, will lead to reduced leadtimes (variability) and a reduction of inventory levels. Additional advantages are the conversion of storage space that can be used to meet other direct patient care needs, and a reduction of operating costs. The prime vendor concept is more fully explored in subsequent sections of this research.

With the GAO report touting the successes of the VUMC and VA, the Bureau of Medicine and Surgery (BUMED) has encouraged the examination of how prime vendor can be integrated with existing inventory management operations. JIT and prime vendor concepts are in their infancy in military medicine and must be thoroughly examined before they can be successfully implemented into hospital operations. This will avoid a "trial and error" approach in acquiring new inventory reduction techniques, that could drive up inventory costs and disrupt patient care. This research will aid in understanding and planning for a JIT system to minimize potential transition effects.

D. RESEARCH FOCUS

The focus of this research is in two major areas. First, is the transformation of JIT concepts from the manufacturing industry to the healthcare sector. Second, and more important, are recommendations of how JIT may apply to inventory management operations at Naval Hospital, Oakland, and what factors are essential to a successful program.

E. ORGANIZATION OF THE THESIS

This research begins with an introduction of the JIT philosophy, its evolution in manufacturing, and its contribution to inventory practices. The techniques of JIT purchasing are introduced, followed by a discussion of JIT applicability in healthcare operations. JIT practices at Vanderbilt University Medical Center are closely analyzed, followed by JIT recommendations applicable to Naval Hospital, Oakland.

This research is based on the following assumptions:

- Federal Acquisition Regulations (FAR) will, or can be modified to, allow for the implementation of specific JIT initiatives, primarily prime vendor. Presently, small purchase requirements are an impediment to prime vendor contracting. This area is being addressed by the BUMED and DPSC, and will not be covered in this thesis.

- Naval Hospital, Oakland, desires to streamline inventory management operations which may result in reduced inventory levels. Much of the success in implementing a JIT system is founded in adopting a strong commitment to the program, fostering team ownership of the program, and revamping traditional methods of inventory operations. The materials management staff has already demonstrated a strong commitment to this effort.

- War reserve material considerations do not hamper the planning for JIT implementation.

The contributions from personnel at Naval Hospital, Oakland, are many. However, the views expressed in this paper are solely those of the authors. This research serves as a reference point and beginning framework for examining JIT concepts, rather than a definitive approach to implementing a JIT system. This is because the organization must remain flexible to current events in order to modify operations and capitalize on emerging practices.

1. Research Methodology

Three methods were used to conduct the research required to develop the recommendations contained in this study. This consisted of a comprehensive literature review, numerous site visits, and personal and telephonic interviews. These techniques were intertwined throughout the research process, each building on the other to present a thorough depiction of JIT.

A comprehensive archival research was conducted of the literature relating to Just-in-Time techniques, inventory control and their relationship to medicine. This consisted of three Defense Logistics Studies Information Exchange bibliography searches, an extensive review of literature at the Naval Postgraduate School Library, two literature reviews by the National Library of Medicine, and review of the medical literature relating to materials management at the Community Hospital of the Monterey Peninsula. Additionally, government literature and publications published by the General Accounting Office,

Department of Veterans Affairs, Defense Personnel Support Center, Office of the Assistant Secretary of Defense for Health Affairs, and BUMED, were reviewed.

Personal interviews were conducted during site visits consisting of four trips to Naval Hospital, Oakland, and one to VUMC and Baxter Healthcare in Nashville, Tennessee. The initial visit to Oakland was to attend a meeting at which a DPSC representative presented the framework for the prime vendor program. The Director for Logistics and the Head, Materials Management Department, were then consulted on the framework for this research and the feasibility for this study. Having decided that a JIT system could be beneficial, interviews and discussions with hospital personnel were conducted to explain the JIT concept and how it might fit the needs of the hospital. These interviews included the Director for Administration, the Director of Nursing Services, the Assistant Director of Nursing Service, two ward Division Officers, five ward Supply Petty Officers, the Head Central Processing and Distribution, and the Head Contracting Department. In addition, an in-depth examination of the current inventory management system was undertaken.

Instrumental to this research was a site visit to VUMC and Baxter Healthcare. While at VUMC we interviewed numerous key players in the initial development of their JIT program, along with personnel instrumental in the daily functioning of their system. This included the Hospital Administrator who conceptualized and implemented the program, two assistants, nursing personnel, the Associate Director of Purchasing, and Service Center Supervisors. Interviews

were also conducted at the prime vendor with the Operations Manager and line personnel. While at VUMC and Baxter, we observed the process in action, both at the hospital and at Baxter Healthcare.

Throughout this research we continually sought the advise and expertise of various personnel at BUMED, DPSC, VA, the Defense Medical Standardization Board, and the Office of the Assistant Secretary of Defense for Health Affairs through telephonic interviews and facsimile transmissions.

Synthesizing the information acquired from the literature, interviews and site visits, we formulated the basis for a successful JIT inventory management system in a hospital setting. We then applied these findings to the situation and requirements of Naval Hospital, Oakland and developed a set of recommendations to consider if they desire to institute a JIT inventory management system.

F. TYPE OF MEDICAL MATERIAL CONSIDERED

Many types of material and services lend themselves to consideration under the JIT philosophy. A major element of a successful JIT system in a medical facility is the relationship that exists between the prime vendor and the hospital. The stronger this relationship, the more widely adopted JIT practices can become. Inventory management at VUMC is moving to a stockless system so that virtually all of their office, pharmaceutical, laundry service, and medical and surgical supplies will be procured using JIT or stockless techniques. The relationship that

exists with their prime vendor is such that they will continue to explore new initiatives that benefit both organizations.

Significant supply support for Naval hospitals is provided by DPSC through standard stock material. However, approximately 50% of all DoD Military Treatment Facility (MTF) purchases of pharmaceuticals and consumable supplies are from local suppliers. [Ref. Sup. 1] Specifically, consumable supplies is the medical material that is targeted in our research and which applies to the JIT concepts discussed in this thesis. For Naval Hospital, Oakland, this equates to approximately $12 million and 26,000 line items of material. [Ref. 9]

The prime vendor program will not immediately alleviate the responsibility for MTF's to order material stocked by DPSC. DPSC is the organization responsible for development and contract management of the prime vendor program available to Naval Hospital, Oakland, and other CONUS sites. As such, they will monitor procurement, safety level considerations, and cost/quality issues. As prime vendors prove capable of providing a timely, high quality, and cost effective product, DPSC will reduce material stocked by the depots. This will result in the procurement of additional material from the prime vendor as standard stock levels are phased-out. An area of concern is the ability of medical/surgical and pharmaceutical manufacturers (the industrial base) to support a dramatic increase in demand brought about in times of war. For routine supplies used in hospitals throughout the country, this should not pose a problem. However, for more specialized items or certain drugs, DPSC will

probably maintain certain safety stock levels to ensure availability. Further discussion of this important topic is, however, beyond the scope of this thesis but one which must be central to JIT planning.

G. CHAPTER SUMMARY

The medical profession is in the midst of a growing health care crisis as the cost of care continues to rise. In the center of this crisis are hospitals faced with decreasing profit margins, and in the military, declining budgets. Every effort must be taken to employ innovative methods to reduce costs at all levels of the organization. This chapter discussed the importance of logistics and the JIT philosophy in improving inventory management operations and reducing logistics costs.

It is estimated that for every dollar spent on the purchase of a supply item, an additional dollar is spent on related costs, such as storage and transportation. [Ref. 1:p. 10] The use of JIT techniques and prime vendor contracting in civilian hospitals has substantially reduced costs and afforded those organizations the opportunity to optimize their limited space. Examples include Tampa General Hospital where warehouse inventory levels dropped from $897,262 in 1985 to $16,115 by 1988, [Ref. 10:p. 55] and hospital inventories decreased from $6.7 million to $3.3 million. [Ref. 11:p. 11] At VUMC, inventory was reduced from $2.4 million in 1988 to $250,000 in 1992, and material management operation expenses were reduced by $800,000 per year. [Ref. 12] In both cases, cash flow was

increased and space previously used to store supplies was converted to revenue generating space.

Prime vendor contracting is an initiative that provides a catalyst for the consideration of a JIT inventory system in Naval hospitals. Although military hospitals have unique mission requirements, as compared to our civilian counterparts, many benefits can nonetheless be realized by adopting JIT techniques. To that end, this research will analyze the JIT philosophy, and the program at VUMC; and discuss important JIT recommendations for consideration by Naval Hospital, Oakland, personnel.

II. JUST-IN-TIME INVENTORY MANAGEMENT

A. INTRODUCTION

The GAO audit on military medical inventories recommended that the Secretary of Defense develop pilot programs using proven commercial inventory practices to reduce DoD medical inventories. [Ref. 6:p. 5] The commercial practices used by civilian hospitals is an adaptation of the *Just-in-Time* (JIT) manufacturing philosophy developed by the Japanese in the 1950s.

A JIT system is dependent on a strong commitment to continually improve processes (inventory management and material purchasing), to improve the quality of products, and to eliminate all wasteful activities, such as long lead times and inspection upon receipt of the item. [Ref. 13:p. 1-2] Waste is defined as "anything other than the minimum amounts of equipment, materials, workers and time which are absolutely essential to production." [Ref. 14:p. 28]

This chapter examines a brief history of the JIT philosophy, providing the reader with a technical overview of JIT, the major principles of the philosophy, and how it is applied in the manufacturing industry. It must be kept in mind that the JIT techniques explored in this chapter will require modification for applicability to medical facilities. But the goal for both manufacturing and

hospital operations remains the same: to eliminate wasteful activities and improve the quality of the product.

B. BACKGROUND

The Just-In-Time philosophy has its roots in post World War II Japan. With limited resources after the war and a determination to hasten economic recovery, the Japanese focused their attention on manufacturing. Their objective was to incorporate Western technology (rather than innovate) and produce consumer goods for export. However, to accomplish this goal, the stigma of poor quality, associated with "Made in Japan," had to be overcome. The Japanese sought new processes *to reduce waste in operations while increasing quality.*

Two individuals became instrumental in developing the philosophies that would guide Japanese industry in the practice of JIT techniques. The first was Taiichi Ohno, a Japanese engineer with Toyota Motor Company. The second was an American, Dr. Edward Deming, a leading figure in statistical quality control. [Ref. 13:p. 7]

C. THE JIT PHILOSOPHY

Taiichi Ohno was instrumental in developing the JIT philosophy. Interestingly, he was greatly influenced by American supermarket operations. What he observed were items being replenished as rapidly as customers picked them from the shelves. He realized that if replenishment did not match demand, too much inventory could accumulate, resulting in increased holding costs and

risking product deterioration. On the other hand, consumers would be disgruntled if items were not in stock, and lost sales would result. Ohno recognized the superior ability of the supermarkets to coordinate the supply and demand of a wide array of perishable products. Further, he noted their ability to efficiently manage the turnover of items and the timing of orders, while minimizing holding costs. [Ref. 13:p. 8] JIT was translated from the "supermarket solution" into a management system designed to meet the precise demands of customers with a minimum of delay. [Ref. 13:p. 8] Ohno incorporated this concept into manufacturing assembly lines by having the pace of the work determined by the last worker in the production line. [Ref. 13:p. 9] In this manner, each stage in the assembly line would receive an item only when it was needed.

Ohno's development is categorized as a pull inventory system, which represented a significant departure from traditional push inventory management systems. Under the former system, the flow of material into a down-stream department is "pulled" from the upstream department as needed. The up-stream department cannot produce parts unless a down-stream department requires them. This system of signalling for more material became known as *Kanban* and will be discussed later in this section. The throughput (output) of the manufacturing process is based on the capacity of the last department, whose capacity is established by consumer demand for the product. Items are manufactured Just-in-Time to meet demand, and subassemblies are produced Just-in-Time within the manufacturing process itself.

In contrast to the pull inventory system used by JIT, the push inventory system is used in more traditional manufacturing plants. Using this approach, up-stream processes continually make parts, irrespective of demand, and pass them along to a down-stream department for further processing. If the down-stream department does not have sufficient capacity, it cannot process all the material that it receives. This causes excess work-in-process (WIP) inventories which remain idle, and are referred to as *waste*.

Excess WIP inventories defeat the Japanese goal of improving quality while eliminating waste. It also increases the inventory carrying costs associated with producing the material. The added costs range from the obvious; opportunity costs, the cost of storage, material handling equipment, and damage/shrinkage, to the not so obvious such as; storage implements (pallets), scrap, rework, deterioration, and lot inspection. [Ref. 15:p. 333-336]

More importantly, excess WIP inventories are counter-productive in improving the quality of the product. With excess inventories the worker has ample buffer stock to replace a defective subassembly with another or ignore defects altogether, since he knows there is ample stock to meet demand. This decreases the quality, as defects will remain hidden during the manufacturing process, and are not discovered until final inspection. This leads to further waste as items are discarded, reworked and, worse yet, customer orders are delayed. In addition, the problem in the manufacturing process which caused the defect is now much more difficult to isolate with the passing of time. [Ref.15:p.334] This

can create unnecessary and unproductive labor cost to correct a problem which could have been solved at the source. Defective material may not be discovered until it is too late to return the items to the supplier. At that point, unusable material presents a potential crisis and results in significant man-hours and costs to rectify the situation.

Under a JIT methodology, the lot size of subassemblies that is pulled from one work station to the next is very small. Thus, the buildup of unnecessary WIP inventory, which is waste, is eliminated. This decrease in WIP represents an immediate decrease in the myriad of carrying costs associated with the item which translates into increased cash flow for the organization.

Small lots also improve quality and decrease scrap. As will be seen later, JIT requires each worker to be responsible for the quality of their work. As a worker makes a few parts and passes them down-stream, he will immediately receive feedback if the quality is not satisfactory. Thus, defects are discovered immediately, at the source, and corrected. [Ref. 16:p. 25]

JIT is a significant departure from Western manufacturing methods where the push method is predominant. The result is excess WIP which is maintained, "Just-in-Case" there is a problem on the line. [Ref. 13:p. 9] In actuality, this only contributes to an increase in costs!

R. J. Schonberger, an American expert on JIT and Japanese management has defined Ohno's principles and JIT as: [Ref. 16:p. 16]

> Produce and deliver finished goods just in time to be sold, subassemblies just in time to be assembled into finished goods, fabricated parts just in time to go into subassemblies, and purchased materials just in time to be transformed into fabricated parts.

Through Ohno's initiative, the *primary* objective of JIT centered around the ability to produce a quality product with minimum waste. This principle adheres to the philosophies of Dr. Deming, the second figure prominent in developing the JIT concept.

In the 1950s, Dr. Deming traveled extensively in Japan to promote the concepts of Total Quality Control (TQC) to that country's leading industrialists. TQC emphasized decreasing inventory levels through smaller lot sizes, thus reducing WIP and in-plant inventories. The adoption by the Japanese of this philosophy had a profound impact on quality improvement in Japan. [Ref. 13:p. 8] As is evident from Table 2-1, Dr. Deming's 14 points and the JIT philosophy complement each other extremely well. Thus the Japanese had the benefit of Ohno and Dr. Deming, both of whom advocated quality and customer service in improving their manufacturing operations. JIT became the goal, and Deming provided the guiding principles to achieve the goal. The next section will examine the major elements of JIT. The reader should note their correlation to Deming's 14 points.

TABLE 2-1. DEMING'S 14 POINTS

1. Create constancy of purpose toward improvement of product and service, with the aim to become competitive and to stay in business, and to provide jobs.
2. Adopt the new philosophy. We are in a new economic age. Western management must awaken to the challenge, must learn their responsibilities, and take on leadership for change.
3. Cease dependence on inspection to achieve quality. Eliminate the need for inspection on a mass basis by building quality into the product in the first place.
4. End the practice of awarding business on the basis of price tag. Instead, minimize total cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.
5. Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.
6. Institute training on the job.
7. Institute leadership. The aim of supervision should be to help people and machines and gadgets do a better job. Supervision of management is in need of overhaul, as well as supervision for production workers.
8. Drive out fear, so that everyone may work effectively for the company.
9. Break down barriers between departments. People in research, design, sales, and production must work as a team, to foresee problems of production that may be encountered with the product of service.
10. Eliminate slogans, exhortations, and targets for the work force asking for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, as the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the work force.
11. (a) Eliminate work standards (quotas) on the factory floor. Substitute leadership. (b) Eliminate management by objective. Eliminate management by numbers, numerical goals. Substitute leadership.
12. (a) Remove barriers that rob the hourly worker of his right to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality. (b) Remove barriers that rob people in management and in engineering of their right to pride of workmanship. This means, *inter alia*, abolishment of the annual or merit rating and of management by objective.
13. Institute a vigorous program of education and self-improvement.
14. Put everybody in the company to work to accomplish the transformation. The transformation is everybody's job.

W. Edwards Deming, *Out of Crisis*. Cambridge, Mass:MIT, Center for Advanced Engineering Study, 1986.

D. ELEMENTS OF JIT

The words *"Made in Japan"* now stand for quality, and American firms have been left in the starting blocks hurriedly trying to get back in the race. The astounding success of JIT/TQC in Japan is becoming obvious as more American companies try to emulate these production methods. In taking the production lead the Japanese have; 1) imported technology, avoiding the high costs and risks associated with research and development, 2) focused their sagacity on manufacturing methods that resulted in high productivity and low unit cost and, 3) pursued the highest levels of quality and reliability, unmatched by their competitors. The implementation strategy of these tactics lies in two basic tenets; the heart of the JIT/TQC philosophy. They are the *elimination of waste* and a *respect for human resources.* [Ref. 17:p. 717] In the following section, we examine in greater detail how these ideals are incorporated into the JIT and TQC philosophies.

1. Elimination of Waste

The following are examples of waste in manufacturing that are eliminated by using a JIT system:

- Excessive inventories.
- Large lot (order) sizes.
- Scrap or expired material.
- Long leadtimes.
- Routine material inspections.

In JIT, the elimination of waste is accomplished through the following seven elements. [Ref. 13:p. 20-25]

a. Focused Factory Networks

These are small specialized production centers rather than typical large scale plants with numerous product lines.

b. Group Technology

This applies to how organizations are designed to perform a variety of operations. It considers all the required operations to produce a specific component and then groups these functions together.

c. Jidoka-Quality at the Source

Similar to Deming's philosophy, this idea embraces the concept of empowering the worker to perform continuous quality control. If a process is not functioning properly, the worker may stop the assembly line to correct the deficiency, thus eliminating the need for subsequent inspections. In this manner, defects are immediately discovered before a vast amount of material is produced.

d. Minimized Setup Time

A significant amount of idle time (waste) can occur when processes need to be setup or changed. Methods to decrease setup times are particularly important with smaller lot sizes. More frequent production runs mandate simplified procedures to ensure cost efficiency. In addition, reduced setup time increases worker efficiency and leads to increased output.

e. Just-in-Time Production

This is producing the exact quantities at the precise time it is needed. One unit more or less than required is contrary to this philosophy. Therefore, customer demand for an item determines production scheduling. Traditionally, scheduling is based on long production runs since setup costs are normally high. With reduced setup costs, production runs can more closely match customer demand. This eliminates inventories and increases customer satisfaction.

f. Uniform Plant Loading

This pertains to how material flows through the production process. Developing material flows that incorporate the flexibility to respond to demand changes in a systematic manner is the goal. This is accomplished through small lot sizes, and frequent orders that can be adjusted to changing demand.

g. Kanban Production Control

Kanban is a signalling device, typically cards or containers, used by a downstream department to pull material from an upstream department. In this manner, excess inventory, WIP, is eliminated.

2. Respect for Human Resources

The second tenet in the JIT/TQC philosophies is the respect for people. A contributing factor to the success of JIT is the motivation of the worker to continually produce a quality product. Strong bonds to the organization must be

developed and job security must be enhanced. The following seven elements are inherent to this philosophy. [Ref. 13:p. 26-31]

a. Lifetime Employment

In Japan, workers have been guaranteed lifetime employment. This leads to a work force committed to the organization, and motivated to ensure its success.

b. Automation/Robotics

The Japanese use these techniques to eliminate dull repetitive tasks. This enables the employee to pursue more meaningful work. Fear of loss of employment through automation/robotics is non-existent due to the Japanese philosophy of lifetime employment.

c. Subcontractor Networks

Close ties are developed with a few subcontractors who furnish the organization with parts or material. *Competitive multi-source contracting is not practiced.* This leads to improved quality as both companies have a mutual interest in the product.

d. Quality Circles

Teams are formed from voluntary workers who meet to discuss and resolve problems within their operational area.

e. Company Unions

Unions in Japan are formed with membership from the entire company as opposed to the Western tradition of trade unions. This allows both the union and management to pursue goals beneficial to the entire organization rather than one group.

f. Attitude Towards Workers

The Japanese believe that every worker should be provided the opportunity to demonstrate their maximum capabilities. This is evident in the fact that the Japanese provide more training and education to their employees than any other industrialized nation. [Ref. 17:p. 728]

g. Bottom-Round Management

This is management by consensus and emphasizes participation by all employees in the discussion and resolution of management issues.

The compilation of these 14 elements becomes the basic ingredients which comprise the JIT philosophy in manufacturing. Application of these principles, in the pure sense of the philosophy, results in having the right amount of material, in the right place, at the right time. JIT was first practiced at Toyota Motor Company, where the principles of elimination of waste and respect for human resources lead to competitive superiority. The process worked as follows.

Through the use of Kanbans (an empty container or a card used to communicate the need for more subassemblies) material was pulled by a down-

stream department from an up-stream department as needed. The up-stream department could not produce subassemblies unless the down-stream department signalled for more parts. By limiting the lot sizes and vigorously reducing buffer stocks between processes, the worker on the line became totally responsible for the quality of the item produced. If the quality was not satisfactory, the worker would stop the assembly line (Jidoka). The line would not be restarted until the problem was resolved. This system placed a strong emphasis on the line worker's capabilities to ensure a quality product was made. The worker was now responsible not only for the quality of the product, but had to ensure that the quality of the subassembly received was satisfactory as well. The worker's ability to recognize problem areas and solutions is instrumental in ensuring that a high quality product is produced with minimum resources. What this amounted to was a melding of the human resources elements with the need to eliminate waste in a symbiotic manner.

For JIT to be successful, the purchasing department becomes an integral player in the manufacturing process. Purchasing can no longer be treated as a simple, clerical function, but must be viewed as a critical profit center, responsible for quality and productivity. [Ref. 14:p. 19] JIT requires suppliers to furnish quality products upon demand. In order to clarify this point, a brief discussion of the increasing importance of the purchasing department and its emerging role, will ensue.

E. JIT AND PURCHASING

For an organization to effectively implement JIT, it must change the focus of its purchasing operations. The emphasis on expanding the scope of purchasing's responsibilities began in the mid-1970s. Many Fortune 500 companies realigned purchasing to an executive level position within the organization. Events such as the oil embargo, shortages of raw material, double-digit inflation, and long leadtimes contributed to the importance of "buying smart." The end result was the need for firms to minimize inventories of raw materials and parts, placing increased emphasis for quality material on the supplier. [Ref. 14:p. 20-25]

As JIT practices intensified in America and Japan, JIT purchasing (JITP) also evolved, as its decision making role was expanded. What has emerged is a JITP philosophy that seeks the following: [Ref. 13:p. 47]

- Defect rates on purchased parts measured in the 100 to 200 parts *per million*. Traditionally, defect rates per hundred were common.
- Supplier participation in the effort to reduce cost and improve quality.
- Substantial reductions in inventory levels.

Traditional purchasing methods cannot attain these goals. The following discussion will examine seven general purchasing functions from the traditional and JIT approaches. It will become obvious that JITP is a more cost effective approach in ordering material. The functions to be analyzed are: [Ref. 14:p. 28-38]

1. Establishing Lot Size

a. Traditional

Large lot sizes are purchased just-in-case there is a disruption in supply. Purchase of large lots is also used because shipping and handling costs are considered a constant, regardless of lot size. Since these costs are allocated to the purchased material, more material is purchased to keep the unit cost as low as possible.

b. JIT

Emphasis is on minimum lot sizes (preferably piece for piece) and frequent deliveries. This allows for tighter inventory and quality control. Parts are simply not allowed to accumulate. More frequent demand also causes the adoption of JIT practices throughout the supply channel as manufacturers respond to orders for increasingly smaller lot sizes. Using JIT, it is felt that the associated increase in transportation costs and lost freight discounts are far outweighed by the improved product quality, decrease in holding costs, and increase in customer responsiveness, which should result in an increase in sales.

2. Selecting the Supplier

a. Traditional

Competitive bidding and multi-source contracting is the norm. The result is a relationship with a supplier who has little interest in providing a top quality product. Due to this short term contractual relationship, the supplier

cannot be convinced to participate in design or improvement of the product. In addition, the contractor may have to 'gear-up' to produce the item. This translates to long leadtimes. Proponents feel that multi-source contracting generally results in greater flexibility in technical areas, protection during times of shortage, and most importantly, the lowest price.

b. JIT

Single source, long term contracts are the goal. Establishment of a long-term relationship with a supplier encourages loyalty and reduces the risk of interrupted deliveries. Smoothing demand variability and reducing long leadtimes eliminates waste. As supplier and buyer enter into a long-term contract, the supplier will work more closely with the buyer to ensure a high quality product in order to maintain the contractual relationship. In addition, this results in a lower long run price as overall volume purchased from one supplier is greater, minimal amounts are spent on re-tooling by the supplier, and paperwork is reduced to a minimum. A long-term relationship will ultimately result in minimum inventories and the elimination of buyer inspection.

3. Evaluating Suppliers

a. Traditional

In evaluating suppliers, the emphasis is placed on; price, performance of delivery schedule, and product quality (normally in that order). A rejection rate of 2 percent is considered acceptable under usual contract

standards. This method of evaluating suppliers implicitly indicates that some degree of poor quality is acceptable.

b. JIT

Evaluation is based on the same criteria as above, however, *no percent of defective product is acceptable*. The focus is placed on product quality and establishing a long-term relationship to reduce variability in procurement.

4. Inspecting Incoming Parts

a. Traditional

The receiving department is responsible for receipt, identification, piece counts and inspection for all incoming parts. Quality acceptance becomes the sole responsibility of the buyer and abrogates supplier responsibility for a quality product. This inspection process increases the administrative leadtime of the item as material sits idle waiting to be inspected. This increased leadtime adds to the inventory level or buffer stock to ensure that the customer has a continual source of product. This is a prime example of waste and should be eliminated.

b. JIT

Except in the case of new suppliers, inspection is *not* required by the buyer. JIT requires quality control to be performed at the source. In establishing a long-term relationship with the supplier, inspection becomes the supplier's responsibility. This ensures that quality is built in before the part leaves the factory. To assure the proper quality programs are in place, the buyer

performs supplier certification. This documents that quality specifications have been met at the supplier's plant. With a long-term contract as motivation, the supplier has a vested interest in ensuring that the parts or material are of the highest quality possible.

5. Negotiating With Suppliers

a. Traditional

Normally, the lowest bid wins the contract as buyers negotiate with multiple sources. With buyers providing exact and rigid specifications to suppliers, product quality is emphasized, but is second to price.

b. JIT

The objective is to establish a close and lasting relationship with the supplier, rather than simply focus on price. In many cases, the lowest bidder is not awarded the contract. Rather, award is based on the supplier who can; 1) consistently provide a high quality product with no inspection by the buyer, 2) is willing to work with the buyer to solve problems, and 3) meet a rigid delivery schedule. After these objectives have been met, buyer and supplier agree on a fair price to both parties.

6. Determining Mode of Transportation

a. Traditional

Scheduling and delivery are generally the responsibility of the supplier. Since the objective is to maximize profit, the manufacturer will seek a

mode of transportation that provides the lowest cost, *not* necessarily the best service.

b. JIT

The success of a JIT program hinges on products being delivered on time. As such, the design of the transportation system that is compatible with the JIT requirements rests with the buyer. Due to the complexities involved in selecting the method and routing of JIT shipments, the buying company must have complete control over inbound freight. Traffic management becomes more concerned with on time delivery rather than with cost.

7. Setting Product Specifications

a. Traditional

Extensive specifications and tolerance limits are developed by engineers in the design of the end product. Purchasing personnel then ensure all product specifications are defined, and communicated to the supplier. This method of product specification provides no motivation to the supplier to improve product design or quality. Procurement problems are left to purchasing personnel to resolve since suppliers are not typically involved in product development.

b. JIT

Product specifications and tolerance limits are developed in coordination with the technical personnel within the requesting organization and

the supplier. The supplier is empowered to change specifications that increase quality. This allows the supplier to be more involved in product improvement and places a greater responsibility on the supplier to improve processes which result in higher quality and lower price.

JIT and traditional methods of purchasing focus on the same basic functions, but, the approach to those functions is markedly different. Table 2-2 provides a summary of these differences. [Ref. 14:p. 30] In order for a firm to implement a JIT system, it must closely examine its purchasing operation and take the necessary steps to adopt JITP practices as specified above. In today's competitive environment, with minimal resources, it is simply not cost effective to conduct business with hundreds of separate vendors and distributors. In JIT, "managing suppliers means aiming for the lowest all-in-cost, the lowest cost when all is said and done, not the lowest initial price per unit." [Ref. 5:p. 19] The bottom line is that the buyer, in adopting the JIT philosophy, must look to establish a long-term relationship with a single supplier. The supplier must in turn take on the responsibility of being an integral part of the buyer's team to improve quality and eliminate waste.

TABLE 2-2. COMPARISON OF JIT AND TRADITIONAL PURCHASING PRACTICES

PURCHASING ACTIVITY	JIT PURCHASING	TRADITIONAL PURCHASING
ESTABLISHING LOT SIZE	Purchase in small lots with frequent deliveries.	Purchases are made in large batches with less frequent deliveries.
SELECTING SUPPLIERS	Single source of supply is selected for a product, in close proximity; with long-term contract.	Multiple sources of supply are selected for a given part, with short term contracts.
EVALUATING SUPPLIERS	Product quality, delivery performance, and price emphasized; no percent of rejects acceptable.	Product quality, delivery performance, and price emphasized; 2% of rejects acceptable.
NEGOTIATING WITH SUPPLIER	Product quality and fair price primary objective.	Lowest price possible is primary objective.
INSPECTING INCOMING PARTS	Counting and inspecting incoming parts is reduced and eventually eliminated.	Buyer responsible for receiving, counting, and inspecting all incoming parts.
DETERMINING MODE OF TRANSPORTATION	Delivery schedule left to buyer; concerned with both inbound and outbound freight.	Delivery schedule left to supplier; concerned with outbound freight and lower costs.
SETTING PRODUCT SPECIFICATIONS	Buyer relies on performance specs, supplier encouraged to be innovative.	Buyer relies on design specs, suppliers have little input.

F. CHAPTER SUMMARY

The goal of post World War II Japan was to produce high quality consumer goods for export. The Japanese resounding achievements in this endeavor are directly linked to their incorporation of the Just-In-Time philosophy into their production processes. Through JIT, high quality goods are produced by following two basic tenants: 1) the elimination of waste, and; 2) respect for human resources. By adhering to these principles, and those of Dr. Deming, the Japanese have now become the leader in producing high quality products, with the rest of the world trying to emulate their success.

Although initially developed for the production industry, the JIT philosophy has crossed over to the service industry. With some modifications, the principles that underlie JIT have been transformed into the health care industry with much success. In the next chapter we will explore this transformation, explaining how this philosophy applies to the medical industry. We then examine the prime vendor concept being implemented throughout Navy medicine.

III. THE APPLICABILITY OF JIT IN MEDICINE

A. INTRODUCTION

Having introduced the theoretical and technical aspects of JIT and its application to the industrial sector, we now focus our attention on the medical industry. Specifically, we turn our discussion to how JIT techniques can be applied to inventory management in a hospital.

In this chapter, we first examine the seven elements required to eliminate waste discussed in Chapter II, and how they must be modified to fit the healthcare industry. The seven factors that relate to respect for human resources will not be specifically discussed in this section. The authors feel that modification of these elements is unnecessary since they are inherent to the TQL philosophy adopted by the Bureau of Medicine and Surgery (BUMED). The adaption of Just-in-time purchasing to the healthcare industry is then discussed, followed by some of the potential benefits that can be derived from a JIT system. Next, we discuss some characteristics inherent to JIT that will impede program effectiveness if not properly addressed as they pertain to hospitals. The basis for much of this discussion will center around our findings from research we conducted at Vanderbilt University Medical Center. Lastly, the prime vendor concept is

introduced, a program crucial to instituting a JIT inventory management system in a hospital.

B. MODIFYING THE SEVEN ELEMENTS OF WASTE

With its roots in the manufacturing industry, JIT was designed to improve assembly line processes. However, this does not suggest that JIT cannot be used to improve the processes in a service industry, such as health care. In fact, quite the contrary is true, as demonstrated by the highly successful JIT program at Vanderbilt University Medical Center.

Whether considering manufacturing or a service industry, the focus remains the same, the elimination of waste. To that end, the seven elements required to eliminate waste are crucial to JIT, however, if applied to a service industry they require modification. In achieving its success, VUMC incorporated a modified version of these elements in their program. Likewise, for a successful program at Naval Hospital, Oakland, these seven elements must be incorporated. The following describes the modifications applied by VUMC and provides a framework for Naval Hospital, Oakland, to consider. These modifications (summarized in Table 3-1) are based on our research of the JIT system used at VUMC.

TABLE 3-1. SEVEN ELEMENTS OF JIT, TRADITIONAL VS. VUMC ADAPTATION.

ELEMENT	TRADITIONAL JIT	MODIFIED JIT AT VUMC
FOCUSED FACTORY NETWORKS	Small, specialized production centers or factories with little vertical integration.	Ward service centers, specializing in patient care needs of ward.
GROUP TECHNOLOGY	Functions or machines required to make product grouped in same location.	Patients grouped according to illness by ward, i.e., pediatric ward or orthopedic ward.
JIDOKA-QUALITY AT THE SOURCE	Worker is totally responsible for quality, has power to stop assembly line.	With limited supplies staff is more attuned to quality of supplies.
MINIMIZED SETUP TIME	Small lots require reduced setups procedures to ensure cost efficient production.	Standardization committee to reduce number of products lines and break bulk issuing of supplies.
JUST-IN-TIME PRODUCTION	Producing exact quantities, at exact time required. One unit more or less than needed is waste.	Use of PAR level shelving, replenish stock daily.
UNIFORM PLANT LOADING	Small lot sizes smooth out material flows in upstream department, as downstream demand changes.	Small lots result in streamlined receipt and distribution processes, results in reduced inventory
KANBAN PRODUCTION	Signalling device, usually card or bin used by downstream process to pull upstream material when needed.	PAR level shelves are stocked with exact quantity in preset locations, results in easy, rapid inventorying.

1. Focused Factory Networks

At VUMC this is known as ward service centers. These are small supply areas located adjacent to inpatient wards. The service center is tasked with providing not only supply support, but all logistical support required by the ward personnel. This includes coordinating such activities as janitorial service, patient transportation, supply replenishment and equipment maintenance. This area is

staffed 24 hours per day, by full-time employees, reporting to the Materials Management Department.

2. Group Technology

At VUMC group technology exists, as each ward provides a specific medical service, i.e., pediatric ward, orthopedic ward, cardiology ward, etc. The staff on each ward is trained to deal with the specific patient needs for that unit. All personnel associated with a particular ward become key members of the patient care team. By embracing the JIT philosophy at VUMC, a custodian for the ward is just as important to providing quality patient care as a nurse.

Group technology also involves fostering a close relationship with the prime vendor. In this manner, all parties concerned with the process (patient care) work to resolve problems as they arise and improve procedures continuously. Teamwork is central to resolving any issues.

3. Jidoka—Quality at the Source

JIT mandates that employees be concerned with the quality of the product, in our case the patient. Although the process of medical care cannot be "stopped" when there is a quality issue, personnel must be attuned to the quality of the supplies they use and take steps in resolving quality issues as they arise. Since there is now a limited amount of supplies available, wasteful practices must be eliminated.

The ward staff at VUMC strongly support this point and feel the quality of care has improved since the implementation of JIT. In particular, the nursing staff stated they now have more time to spend in providing patient care, since supply support has dramatically improved. Monthly meetings involving nursing, supply, and prime vendor personnel are held to resolve supply issues.

4. Minimized Setup Time

At VUMC setups have been reduced utilizing two techniques; a) standardization of material and b) break bulk purchasing.

VUMC has established a supply standardization committee, whose role is to ensure that products are of high quality and duplication of items is eliminated. This creates hospital wide familiarity with patient care items and leads to improved quality of care for the following reasons: a) the product learning rate decreases as item familiarity increases, b) only products of the highest quality are procured, and c) standardization promotes a long-term relationship with a manufacturer contributing to continuous quality improvement.

Break bulk is the practice of taking case lots of items and issuing the material in the smallest unit possible. For example, under traditional methods, a case of IV infusion sets might contain 48 units and be sold to a ward by the case. Using break bulk, the IV sets are issued as units of one, enabling the ward to order the exact quantity, at the exact time of demand.

Issuing material in this manner requires less storage space and eliminates loss due to expiration. Further, quality issues surface immediately since

there is not a large buffer stock to conceal errors or defective material. The ability of service center personnel to purchase items in single units is an important contribution to the success of JIT at VUMC.

5. Just-in-Time Production

Ward operations are a continuous process, as such, the exact patient mix is not known in advance. Therefore, supply requirements cannot be precisely established in a pure JIT sense. To minimize stock levels, VUMC uses PAR level stocking. This consists of small storage spaces on each ward that holds approximately 24 hours worth of supplies. On a daily basis the Service Center staff quickly inventories all supplies and places an order with the prime vendor. Delivery of the items is received later in that day and the shelves are replenished. Although some supplies may sit for 24-36 hours, most items turnover every 24 hours.

Prior to JIT, the wards maintained excess stocks to protect against stockouts. This material quite often remained on the shelf anywhere from two weeks to six months. Additionally, staff members horded supplies that had a frequent history of being out of stock. Today, not-in-stock occurrences are extremely rare at VUMC, as they have virtually a 100% fill rate since switching to JIT. Personnel no longer horde supplies, as they have confidence in the supply system.

6. Uniform Plant Loading

VUMC's pre-JIT supply receipt and distribution system was a complex process, with supplies being handled many times. Under this system supplies were received at a loading dock, transferred to a central warehouse, and stocked on shelves. They were then distributed throughout the hospital as orders were received at the warehouse. The material would then be stored on end-use shelves until needed for patient care. This was a never ending process, as supplies were received continuously throughout the day from numerous vendors.

Under JIT, supplies are received two or three times a day from one or two prime vendors and delivered directly to the requesting ward. Once on the ward, they are placed on the PAR level stock shelves. Supplies no longer sit on loading docks or in warehouses waiting to be processed or distributed. JIT has eliminated the waste associated with excess inventories that were maintained to compensate for handling and processing time.

7. Kanban Production Control

The signalling of supply replenishment, using PAR level stockage, is accomplished easily and rapidly. Items maintained on the shelves, in specified quantities and locations, are inventoried by Service Center technicians daily. As supplies are needed, orders are placed with the prime vendor and delivered at a specified time, usually within 4-6 hours of order placement.

C. APPLICABILITY OF JIT PURCHASING

Any organization that is going to transition from conventional inventory control to JIT must incorporate JIT purchasing (JITP) techniques to be fully successful.

The adaptation to JITP in a healthcare setting is the same as it would be in a production industry. As such, no specific modifications to the principles are required, as is the case with the seven elements to eliminate waste. It is simply a matter of the purchasing department examining its current contracting practices and converting them to JITP. However, this will be no easy task, as mind sets must be changed as to how purchasing interacts with its customers, and the vendors.

In the case of a hospital, purchasing agents must work more closely with the nursing staff to procure the quality required, in the quantity desired, and within the time frame needed. This means understanding the patient care needs and assisting nursing in obtaining the required product. In dealing with vendors, the purchasing agent can no longer make a decision to buy an item based solely on the lowest price. He/she must now consider the vendor's ability to accurately ship more frequent, smaller lots; and must be assured that the quality is of the highest standard. Additionally, the adversarial relationships that may develop around pricing and competition issues, between purchasing and the vendor, need to be broken down.

One unique aspect of JIT in healthcare, that effects purchasing, is the use of a prime vendor (PV). Use of this intermediary warehouse, between the hospital and the manufacturer, will require some innovative contract methodologies. As will be seen, the partnership that must develop between the PV and the hospital causes some anxiety for a manufacturer. This may involve three way negotiations between the hospital, the PV, and the producer to fully explain the new relationship. The following chapter provides a more detailed look at this issue as we discuss the specific changes at VUMC.

D. BENEFITS OF JIT IN HEALTH CARE

As previously discussed, many benefits were derived from JIT as it evolved in the production industry. Most of these benefits centered around increasing profits by improving manufacturing processes, decreasing scrap and increasing the quality of the product.

Since providing health care is not the same as a production process, a natural question at this juncture is: What benefits can be expected from a JIT program at Naval Hospital, Oakland? They include;

1. Increase in Cash Flow

Under a JIT program, a hospital can decrease inventory levels, resulting in reduced supply expenditures. For Naval Hospital, Oakland, this results in a one time increase in obligational authority (cash flow), as funds earmarked for inventory replenishment can be redirected for other pressing patient care

concerns, such as new equipment. With diminishing budgets, methods must be exhausted to gain maximum value for each dollar spent. Monies allocated to excessive inventories is not a prudent expenditure of funds because other, more vital, services go unfunded.

2. Improved Quality of Care

A JIT system will result in a faster, more reliable receipt of supplies. This allows nursing personnel, previously frustrated by supply issues, to focus their attention on patient care. In addition, loss due to shelf life expiration will disappear, ensuring that the specified product for the patient is available upon demand.

3. Space Savings

As the variability in supply receipt is lessened and inventory levels are reduced, the facility will acquire space once used for supply storage. In most instances, this space can be converted to patient care areas or other uses. This can result in increased patient workload or expansion of services for Naval Hospital, Oakland.

4. Improved Teamwork Throughout the Organization

As personnel work toward a JIT system, a more cohesive patient care team will emerge. With minimal inventory levels, JIT requires that all personnel involved in patient care communicate more closely and frequently. This is evident at VUMC as the Material Management Department is now considered an integral

member of the healthcare team. Supply personnel are viewed as problem solvers, as they use their expertise to obtain needed patient supplies. The result is a better working relationship among the staff, which ultimately leads to improved quality of care.

Specifically absent from this list of benefits are reductions in personnel due to the implementation of JIT practices. While private industry touts personnel reductions as a "by-product" of JIT, we have chosen to exclude this from our discussion. One of the top priorities in implementing a JIT system is to follow Deming's rule number eight; fear in the workplace must be eliminated for employees to give maximum effort to the organization. This means we do not expect, promote, or actively seek, personnel cuts. If positions can be realigned to streamline processes, then they should be considered. If personnel can be attrited, then this may indeed be a benefit. However, we do not *anticipate* personnel reductions.

E. JIT CHARACTERISTICS TO BE CONSIDERED

The present method of inventory management in Navy medicine can be characterized as a "Just-in-Case" (JIC) system. That is large, stagnate amounts of inventory are maintained just-in-case they are needed. The primary reason for these excesses is that procurement leadtime is typically very long and corresponding high safety stocks are needed to protect against a stockout. As JIT

techniques gradually reduce inventories, a hospital transitions from a JIC system of excess inventory levels, to a JIT system with minimal stocks.

To maintain adequate stock levels a JIC system uses an economic order quantity model. This model uses past demand to forecast future supply requirements and results in large inventories of buffer or safety stock. This excess stock is required to support such things as long order and ship leadtimes, war readiness material requirements, and fluctuating demand. Quite frequently, this amounts to three to six months, and in some cases years of idle inventory.

As practiced in the private sector JIT embodies specific features that are central to its success, but differ from the JIC system practiced in the military. These features must be addressed in the context of a military environment if similar successes are to be experienced. These features are as follows:

1. Profit Motivation

One of the primary distinctions between the private and public sectors is the "profit motive." In the manufacturing industry, JIT was quickly adopted because of the cost savings and improvement in quality leading to a competitive advantage. This in turn led to increased sales and subsequently, improved cash flow. This is a continuous cycle as JIT strives to improve quality and maximize cash flow. In the military, the incentive to increase profits is lacking, as the emphasis is placed on spending a total budget.

For JIT to work at Naval Hospital, Oakland, incentives toward reallocation of resources and improvement in quality must be given top priority.

As dollars tied up in inventory decrease, the flexibility to channel monies for other patient care needs arise. With hospital commanders placing an emphasis on increasing patient workload, the savings achieved from prudent inventory practices can be used to "buy more health care."

2. Demand Cycles

In comparing the processes that comprise the healthcare and production industries, it is evident that they are very dissimilar. A repetitive manufacturing process provides the ability to regulate the production flow as demand is more deterministic. Supply requirements can, therefore, be predicted more accurately. On the other hand, health care is a dynamic process where patient flow is hard to predict, and no two procedures or patients will necessarily yield the same requirements. This makes forecasting of demand, and the required supplies, extremely difficult.

Demand variability is a compelling reason for considering JIT techniques. Since demand for supplies cannot be reasonably predicted with any confidence, daily ordering procedures and improved supply quality lead to availability of supplies as required and minimize the need for "Just-in-Case stocks."

3. Safety Stock Requirements

In manufacturing, JIT strives to produce each unit according to current demand and eliminate virtually all excess inventory. In this idealistic situation,

there are no parts or subassemblies waiting to be worked on, nor stock maintained in case there is a problem. All work-in-process is sold immediately upon completion.

This is not the nature of military healthcare where unique requirements mandate that safety stocks be maintained. JIT techniques can be used to ensure that these levels are at a minimum and adequate procedures for their upkeep are in place. The following issues require examination at Naval Hospital, Oakland, which mandate higher safety stock levels than a pure JIT system advocates:

- Demand uncertainties.
- Disaster/readiness planning.
- Life/death issues.

a. Demand Uncertainties

As discussed in the previous section, hospitals operate under constant uncertainty. Patient loads (demand) are highly variable with significant seasonal fluctuations. Unlike manufacturing, hospitals are in severe jeopardy if patient care is minimized due to the unavailability of medical supplies.

VUMC has found it necessary to create a safety stock level of 400 critical care items. Material management personnel and nursing service are working together to reduce this number to 250 line items. Whatever the level, this represents a small number of line items, relative to the original inventory levels. Likewise, Naval Hospital, Oakland will undoubtedly maintain a certain number

of line items as safety stocks. The key is to work closely with nursing service personnel to minimize this number.

b. Disaster/Readiness Planning

Unlike civilian hospitals, military hospitals are required to maintain certain stocks for disaster preparedness and wartime contingency. This will necessarily cause higher inventory levels, but must be nonetheless maintained.

c. Life/Death Issues

Certain material must be maintained that is vital in life or limb instances. Emergency and operating rooms are two areas that must maintain these items. Hospital personnel should identify these supplies and decide on appropriate stockage levels.

All of the aforementioned categories will necessarily drive up inventory levels. This is unavoidable due to mission requirements. However, a strategy to manage these supplies within the context of a JIT system is all the more important. Rotation of dated material, storage requirements, procedures to examine inventory levels, and item criticality need to be established and reviewed periodically. For example, VUMC has a buy-back arrangement with the PV for short dated material. The PV has assumed the responsibility of selling this material to customers before it expires.

4. Government Purchase Regulations

Just-in-Time purchasing practices emphasize the fewest possible suppliers providing the highest quality products. Unlike the emphasis from Federal Procurement Regulations, lowest price, in a JIT system, is not the primary concern.

The private sector maintains a great deal of flexibility in the procurement of supplies. The government, on the other hand, is bound by restrictive procurement regulations that require competition among many suppliers. This results in increased leadtime, which in turn leads to increased safety stocks.

The prime vendor program is a mechanism that enables Naval Hospital, Oakland, to effectively deal with government procurement regulations that would normally inhibit the JIT process. This program will streamline ordering procedures, reduce leadtimes, develop relations with two vendors and simplify distribution procedures.

Naval Hospital, Oakland, has unique mission responsibilities and is surrounded by comprehensive governmental regulations. These areas must be fully examined and properly addressed within the JIT context, or there will be difficulties in developing a successful program.

F. THE PRIME VENDOR PROGRAM

Thus far this research has focused on the basic components that comprise the JIT philosophy and the integral role of adopting JIT purchasing techniques. We now turn our attention to a program called prime vendor. It is through PV that hospitals are able to unite these two aspects and effectively implement a JIT program.

1. Fundamentals of a Prime Vendor Program

A prime vendor is a business concern, external to the hospital, that performs many of the hospital's primary logistical functions. This includes warehousing supplies, break bulk packaging, serving as intermediary with manufacturers, and functioning as a distribution center. All of the carrying costs (discussed in Chapter II) associated with these functions are passed on to the PV.

Under a traditional system, the hospital establishes individual purchase orders with hundreds of manufacturers. Supplies are shipped to the hospital and warehoused. Large inventories of supplies are maintained as safety stock to meet the responsibility of ensuring that supplies are received on time and in the right quantity. Even so, stock outages occur primarily due to the variability in leadtimes.

Under a prime vendor concept, the hospital has prearranged agreements with various manufacturers to distribute their products through the PV, at an established price. The hospital places orders with the PV via an interactive computer system and generally receives order confirmation within 2-4

hours. At this point the hospital will know if any items are not-in-stock and if substitutes are available. Adequate time is provided to alleviate any possible stock outages. Leadtime variability is nearly eliminated as most supplies are delivered within 24 hours. The PV orders directly from the manufacturers and must maintain sufficient stock to meet the hospital's demand. A sound relationship must exist between the prime vendor and the hospital for the requirements of JIT to be implemented.

2. Prime Vendor's Correlation to JIT

PV allows the hospital to incorporate many of the 14 points of JIT discussed in the previous chapter concerning the elimination of waste, and human resources principles. The prime vendor program provides the foundation for implementation of JIT techniques such as standardization, break-bulk, and small order quantities. In general, JIT requires the distributor to deliver supplies more often and in smaller quantities. This is achieved through the prime vendor program. The advantage for the hospital is that "the distributor takes on more physical distribution costs for storing, handling, and transporting the product and passes some of these costs to the health care provider." [Ref. 18:p. 61.] However, as previously discussed, while the hospital may pay a slightly higher unit price, it achieves overall, long run cost savings that substantially offset the unit price increases. [Ref. 18:p. 61]

PV has substantially reduced inventories at VUMC [Ref. 6:p. 21] and the Veterans Administration. [Ref. 19:p. 3] Fundamentally, the prime vendor

concept establishes a close working relationship with few selected sources to reduce procurement leadtime and assure stock availability when needed by the customer. This eliminates the necessity for hospitals to maintain costly inventories, avoids potential waste due to obsolescence or shelf-life expiration, and contributes to high standards of quality care through more exacting inventory management standards.

The establishment of a close relationship with select suppliers is point four in the 14 principles of Total Quality Control as advocated by Deming. Adoption of the prime vendor concept is then wholly consistent with Total Quality Leadership as embraced by Navy Medicine.

3. DoD's Focus on Prime Vendor

A strategic planning conference in DoD Health Affairs, tasked with assessing proven industry business practices for adoption by DoD activities, identified three initiatives to pursue in the logistics arena. [Ref. 20] One initiative is to reduce inventories through the use of prime vendors. This program relies on competitively selected contractors (one for medical/surgical supplies and one for pharmaceuticals) as the primary source of supplies for all medical care facilities in a given geographic region, defined by DPSC as 300 miles. As an example of documented benefits the VA touts the following achievements: [Ref. 8:p. 1-2]

- Confirmation of availability 20 minutes after order is placed.
- Delivery of better than 95% of the items requested within 24 hours after order is placed.

- Delivery of remaining items within 5-7 days after order.
- Inventory reductions of up to 50% per hospital.
- Potential cost savings of up to 10% of supply budgets.
- Payment of government supply bills within 14 days.
- Virtual paperless ordering, receiving, and invoicing.
- Reduced paper records for audit purposes.

Vanderbilt University Medical Center has achieved similar documented results with the most dramatic as follows: [Ref. 12]

- Reduction of medical supply storage space of 40,000 square feet converted to revenue generating centers.
- Closure of loading docks with prime vendor delivering all material to the hospital user twice daily.
- Reduction of annual operating costs by $800,000.
- Improved cash flow by $2.0 million.

It is for these reasons that DoD has pursued a prime vendor program for military medicine. More will be discussed in the next chapter about the particular aspects considered by VUMC before implementing a JIT system using a prime vendor program.

DPSC plans to launch a prime vendor program in late 1992 on the east coast and early 1993 on the west coast. This enables medical facilities to procure certain medical/surgical stocks which had been traditionally procured from many sources on a competitive basis.

DPSC will retain program management for the prime vendor initiative. In essence, they will negotiate Distribution and Pricing Agreements (DAPAs) with manufacturers to secure the proper pricing and delivery schedules. Additionally, DPSC is responsible for contract disputes and payment of invoices. DPSC contracting personnel have stated that facilities in a geographic region will have substantial input to contract specifications prior to contract award. [Ref. 21]

Advocates of the prime vendor program are adamant that the military's unique mission will be unaffected by the program. Others argue that since the material will be ordered from the private sector rather than stocked in government facilities, it will not be available in times of crisis. This issue is being addressed by many agencies including the Defense Material Standardization Board.

This Board is responsible for classifying those consumables for which the civilian industrial base has sufficient capacity to meet a sharp increase in demand by the services. Therefore, this classification of material lends itself to contracting under the prime vendor program. Further, they have developed of a "D-Day" significant list containing 1600 consumable medical items that will are critical for initial mission capability. [Ref. 22]

Development of an effective JIT system requires a PV contract tailored to meet the unique requirements of the hospital. To that end, DPSC and hospital personnel must "partner-up" to resolve the following issues and structure the most favorable program possible.

a. Contractor Selection

What criteria and pricing strategies will be effected by DoD in the selection of the contractor? The emphasis should be on establishing and maintaining a trusting rapport while improving product quality and supply availability.

b. Evaluation Criteria

The prime vendor program will be evaluated according to criteria and weights established by DoD personnel. How were these weights selected and are they appropriate in all circumstances? Should individual hospitals devise unique monitoring criteria?

c. Inventory Baseline Data

This is perhaps the most important information that will be accumulated and provided by Naval Hospital, Oakland, to the PV. Unfortunately, good demand data, for the type of material being contracted, is usually not precise. For the prime vendor to be successful in responding to the needs of the hospital, demand information furnished to the prime vendor must be accurate. This information should be gathered 10-12 months in advance of contract award to account for seasonality and demand fluctuations.

d. Standardization

This is an important area to be addressed in preparing for a prime vendor contract. In the DPSC plan, the prime vendor will have a wide variety of

product lines available to the customer. As VUMC has chosen, we suggest that Naval Hospital, Oakland, concentrate on standardizing its product lines. Standardization enables the PV to minimize its overhead costs by carrying less product lines.

e. Wartime Readiness

What supplies and levels are appropriate, and how should these stocks be managed in a JIT system?

f. Interactive Information Systems

Another key area of importance to the prime vendor contract is information systems. The hospital will use computer hardware and software furnished by the contractor to order supplies. The ability of these systems to be integrated into existing information management systems is crucial. This area is being addressed by DPSC and hospital personnel can be instrumental in resolving this issue.

g. Contingency Planning

In the event that the prime vendor program must be terminated, what alternatives exist for material procurement?

h. Delivery of Material

Many points concerning the delivery and packaging of materials need to be addressed. These include: the number and location of delivery sites;

the frequency and hours of delivery; whether material is packaged in site specific containers or delivered in bulk.

All of these issues require in-depth analysis to ensure that the prime vendor initiative, once implemented, is successful. While DPSC is primarily responsible for decisions in these areas, Naval Hospital, Oakland, must become a partner in the process to ensure that accurate data and relevant plans are effected. This is a critical point because a successful program will depend on the relationship that exists between the hospital and the prime vendor.

G. CHAPTER SUMMARY

This chapter provided the foundation of how JIT techniques have been transformed from industry operations to the healthcare sector. From experiences at the Veterans Administration and VUMC, it is clear that JIT has been successful in reducing inventory levels, costs, cutting waste, and developing a more cohesive team approach to patient care. Further, JIT embraces many points of Deming's Total Quality Management philosophy and therefore, is consistent with Navy Medicine's philosophy of TQL.

Many of the benefits achieved in industry can be realized by Naval Hospital, Oakland, with the adoption of innovative new practices aimed at reducing on-hand inventories. One such method is prime vendor which will be available to Naval Hospital, Oakland in 1993. As we begin to assess how to implement prime vendor into existing hospital operations, material managers must critically assess

the characteristics of PV and how they apply to their operations. As a detailed prime vendor implementation plan is assembled by the hospital staff, JIT initiatives should be considered which will complement prime vendor operations.

IV. VANDERBILT UNIVERSITY MEDICAL CENTER[2]

A. INTRODUCTION

This chapter examines how Vanderbilt University Medical Center (VUMC) has successfully implemented a JIT program of inventory management utilizing a prime vendor. The JIT program spans the entire medical center with the exception of the operating room. This service is not considered appropriate for JIT at this time because of the nature of the services provided (organ transplants) and the critical nature of the inventories that must be maintained.

The similarities between the missions of Vanderbilt University Medical Center and Naval Hospital, Oakland, are striking. Both are large teaching hospitals, providing a full range of medical services. In addition, both hospitals support large outpatient clinic operations. VUMC's ability to implement and administer a JIT system is therefore pertinent to the establishment of a similar program at Naval Hospital, Oakland. Specifically, our analysis will cover the following areas:

- Background: Vanderbilt University Medical Center.
- Transition to JIT.

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[2] Much of the research for this chapter was obtained from interviews with Ray Ward, Hospital Administrator for VUMC, and his staff. His permission was sought, and attained, for publication of this chapter in its entirety.

- Purchasing's Changing Role at VUMC.
- Baxter Healthcare-The Prime Vendor for VUMC.
- Implementation Difficulties.

B. BACKGROUND: VANDERBILT UNIVERSITY MEDICAL CENTER

VUMC is a 661 bed teaching hospital and medical research center, located in Nashville, Tennessee. The facility consists of 15 buildings, covering 3.6 million square feet. VUMC provides extensive outpatient services in which approximately 240,000 patients are seen per year. Additionally, VUMC has an emergency room offering the most advanced shock/trauma capabilities available. Inpatient services range from routine surgical procedures to the most complicated cancer/cardiac treatments and organ transplants. VUMC also supports medical and nursing schools and a medical research facility.

The Materials Management Department is responsible for providing supply support for the entire medical center. To orchestrate the logistical operations is an enormously complex task and requires the dedication of many skilled people to ensure supplies are received at the right place, at the right time, in the right quantity.

Before 1988, inventory management techniques at VUMC were very similar to those employed at Naval Hospital, Oakland, in terms of procurement requirements and inventory levels. However, through its strategic plan, spanning the past seven years, the hospital has *incrementally* implemented a JIT inventory

system for its inpatient centers and is expanding this concept to include outpatient clinics and the operating room. Eventually, a stockless system is envisioned in most patient care areas. Implementation of a JIT system has resulted in the following improvements:

1. Reduced inventory levels from $2.4 million in 1988 to $250,000 in 1991. VUMC currently maintains safety stocks of approximately 400 line items and is steadily reducing this number.

2. Decreased the number of suppliers from 2000 to two prime vendors. An exception is approximately 30 manufacturers who presently will not distribute through either prime vendor. The goal is to remedy this situation and have all manufacturers distribute through the prime vendors by 1993.

3. Cut non-labor costs per patient day from $31.55 in 1989 to $27.11 in 1991.

4. Re-allocated 40,000 square feet of space from inventory storage to patient-revenue generating centers. In addition, they have completely closed their loading docks as the prime vendor delivers supplies directly to the patient care areas.

5. Reduced the Materials Management staff, primarily through attrition, from 123 full-time equivalents (FTEs) in 1986 to 63 FTEs in 1991.

6. Greatly improved employee job satisfaction, staff morale, and the working relationship between nursing and the material management/purchasing departments. This is perhaps the area where VUMC has achieved the greatest benefits, but not in terms of dollars. The open communication and teamwork that exists between all levels of the organization at VUMC, as a result of JIT, supports Deming's rule nine of his TQC philosophy; that barriers are eliminated between departmental lines and people work as a team. All personnel are seen as essential to the delivery of excellent healthcare, and as such, are treated as integral members of the medical team. This organizational climate enables personnel to conduct business freely, and they are more accepting of new ideas and are motivated in helping the organization prosper.

Naval Hospital, Oakland, can achieve significant improvements, similar to those cited above, in seeking to reduce its inventory levels. The key lies in a thorough understanding of how VUMC capitalized on the prime vendor program, developed a methodical JIT strategy, and continued to exploit the benefits of JIT techniques through the years.

C. TRANSITION TO JIT

In large measure, the success of JIT at VUMC is attributed to the following:

- Commitment to the program.
- Internal and external team-building.
- Incremental implementation.

Each of these points are fully discussed in the following sections and the lessons learned at VUMC are presented.

1. Commitment to the Program

JIT is more than implementing a new program-it is a philosophical change to the mindset of personnel on how business is conducted within the organization. Therefore, it requires "that top management must be firmly committed to and supportive of [the JIT philosophy]." [Ref. 1:p. 10] A commitment of this magnitude requires a person to function as a dedicated "change agent." Lee Grossman, in his book entitled *The Change Agent*, states that such an individual, or team, is essential to effecting change within the organization. [Ref. 23:p. 12-15]

To effect change, this individual must have the positional authority to make autonomous decisions, and have access to top management. Further, he/she must possess a clear understanding of who the stakeholders are in implementing a new program and the power they possess. In addition, he/she provides the sustained motivation and vision essential to ensure the program endures.

At VUMC, this person is the Hospital Manager, Ray Ward. He is a dynamic manager, who envisioned the direction toward JIT and communicated the goals throughout the organization. He continues to integrate the staff into a cohesive team with a vested interest in the success of the program. He serves as the focal point for communications within and outside the organization, and ensures that progress toward the goals of the program are steadily achieved despite occasional "course corrections."

In 1985, Ray Ward set into motion a ten year strategic plan that revolutionized materials management at VUMC. It is largely through his dynamic efforts, to acquire and maintain a strong organizational commitment, that this program has succeeded. In fact, VUMC serves as a model to the industry in how JIT can be implemented in hospitals.

2. Internal and External Teambuilding

A prerequisite to implementing a successful JIT program is that all personnel acquire a thorough understanding of the JIT philosophy and its contributions to the organization. [Ref. 1:p. 9] This is accomplished through education and training programs, with the ultimate goal of building a cohesive

team throughout the organization. Mr. Ward clearly stated, as did his staff, that they began to communicate to hospital personnel their ideas concerning prime vendor approximately one year in advance of actual implementation.

Although Mr. Ward developed the conceptual framework for a JIT inventory system, he sent two staff members to study JIT inventory practices at Tampa General Hospital. While Mr. Ward concentrated his energies on securing and maintaining the commitment of top management, his staff set about the task of educating other personnel throughout the organization on the benefits of JIT.

Informal meetings, luncheons, and group discussions were the forums for open conversation about the program, and occurred frequently during the year. A JIT task force was established with the following goals.

- Establish JIT program objectives.
- Determine and assign implementation tasks.
- Monitor program implementation and accomplishment of objectives.
- Promote continuing education pertaining to JIT.

It is important to note that the initial task force consisted of personnel from nursing, pharmacy, and materials management. As the JIT concept evolved, the task force was expanded to include personnel from finance, administration, purchasing, and internal auditing. However, despite detailed planning efforts, increased workload in accounts payable was not anticipated. The result of this

oversight was that personnel in this department were unprepared for this substantial increase in workload.

According to Mr. Larry Lymon, Director for Materials Management, nursing personnel gradually adopted the idea and began to tout its merits as they recognized the significant easing of their burdens in daily supply matters. A vested interest in the success of prime vendor began to permeate the organization.

It is equally important to develop a team approach with the prime vendor. This is not to say that disputes and disagreements do not occur. They do! But because both organizations are dependent on the other for long-term success of the program, problems are resolved expeditiously. In fact, Baxter Healthcare (the prime vendor for VUMC) has devoted an entire division to servicing VUMC. This team approach has been strengthened during the past four years. Monthly meetings are held between Baxter Healthcare, Nursing Service, the Materials Management Department, and any other interested parties throughout the organization. The key is for personnel, at all levels of the organization, to resolve problems directly with the vendor when possible, building an atmosphere of mutual trust and confidence.

The bottom line is that JIT is built on the ability to successfully communicate ideas and develop teamwork throughout the organization and with the PV. While this may seem to be an obvious point, we too often state the importance of communication and teamwork but pay lip service to it in reality.

While at VUMC, it was the authors' perception that this organization epitomizes the goals of open communications.

3. Incremental Implementation

When an organization faces a major change in how it conducts business, it is best accomplished in stages. This builds user confidence as experience increases and keeps major operational changes transparent to the user. In other words, as JIT is gradually phased in, supply availability will be unaffected (or actually increase) and personnel will not be concerned with how the process has changed. Faced with a major change to the supply and distribution system, Mr. Ward decided on the following incremental implementation plan.

a. Initial Program Start-up

Before JIT could be implemented it had to be determined what to do with the excess inventory held by VUMC. A "buy-back" arrangement, with the PV, for material held in excess of 30 days demand, was structured. Under this agreement, material was not actually returned to the PV, but was maintained at VUMC as safety stock. This stock was held for approximately one year, after which the program was deemed successful and the material was returned to the PV. This is one example of the efforts undertaken by VUMC and the PV to mutually resolve complex issues.

The implementation began with 18 line items, servicing one department. Having proved successful, additional departments were then added to the PV program. Within two months the number of line items distributed through the PV was expanded to 1800. As the success of the PV initiative and JIT continued, approximately 50 line items were added each month.

During this initial phase, user departments would submit their orders to the Materials Center, who in turn transmitted them to the PV. The material was shipped in bulk to the loading dock where it was broken down for subsequent delivery to the respective ordering departments.

b. Deliveries Directly to the User

After this initial test proved to be effective and the program was running smoothly, VUMC took the next step, which was considered the most critical aspect in developing a JIT system. This involved having the PV deliver the supplies directly to the end user and required switching supply replenishment operations from days to nights.

Initially, this entailed six Material Center employees inventorying the PAR level shelves on 44 nursing units starting at 10:00 PM. After the inventory was completed, stock requests were transmitted via modem to Central Supply. A data entry operator created a purchase order and electronically transmitted that order to the PV. The orders were filled at the PV warehouse, packaged by ward destination and delivered to VUMC. The orders were then

received by Central Supply Staff and PAR level shelves on the wards were restocked.

c. Development of Ward Service Centers

Another major change in the evolution of JIT was the establishment of Ward Service Centers. The development of these centers was made possible for two reasons: 1) confidence had developed in the ability of the prime vendor to meet its delivery obligations, with essentially a 100% fill rate and no defects, and 2) an integrated computer system was developed. The Service Centers are being phased in over several years because of limited space and cost considerations. The last two centers are due to be completed in the coming year.

The responsibility of a Ward Service Center is to coordinate the myriad of logistical needs for their particular ward. The benefit is that nursing personnel are relieved of those administrative burdens, leaving them to attend to direct patient care needs.

Presently, each ward at VUMC has an integrated healthcare delivery team that functions as a self-sustaining unit. All personnel work together as a healthcare team, dedicated to providing the highest quality of patient care.

D. PURCHASING'S CHANGING ROLE AT VUMC

1. A New Philosophy

As Vanderbilt entered the Just-in-Time arena, it had to examine its contracting methodologies and determine what changes were required. This required a philosophical, as well as procedural change, to their approach to contracting for supplies and services. In his book, *Just-in-Time Purchasing*, A. Ansari states: [Ref. 14:p. 52]

> When a company adopts the JIT purchasing philosophy, the role of the buyer changes. Basic functions (locating good suppliers, negotiating contracts, expediting orders, and following up to assure compliance with purchasing system standards) remain the same, but the response of the buyer changes. The buyer becomes more active, working very closely with suppliers to establish long-term relationships for better quality and thus implementing JIT.

The philosophical change began a year before JIT was initiated with the creation of the implementation team. As the JIT philosophy unfolded in these meetings, it was realized by all parties that JIT would result in significant cost savings, while improving the ability to provide quality care. However, it was also realized that with little buffer stock and an emphasis on the elimination of wasteful activities, all departments had to work together as partners for this program to be successful. The role of purchasing, within this web, became much more complex, as they now were a direct link to the healthcare delivery team.

2. Internal Changes

Prior to JIT, purchasing's role at VUMC was that of a contractor, seeking to procure material, with requested specification, at the lowest price. There was very little interaction between a purchasing agent and the medical staff members responsible for requesting items; or between the purchasing agent and the supplier (other than price, quantity, and delivery schedule). Their role in support of the medical mission was primarily a clerical one; to place orders, and process invoices for payment.

JIT changed this role, as purchasing became a crucial member of the healthcare delivery team. With the elimination of excess inventories, there was no room for wasteful mistakes. Now, prior to establishing contracts, purchasing obtains input from various departments to ensure that a sound procurement decision was made. This led to a close relationship with medical staff members responsible for ordering and using patient care items.

The expanding role went beyond teaming up with the medical staff, and meant taking on functions previously performed by the Materials Management Department. Purchasing now has a direct input into the management and replenishment of inventories, and the flow of material throughout the hospital. Purchasing's view of their role changed in this new environment. As David Jones, the Director of Vanderbilt University Purchasing stated: [Ref. 24]

Purchasing must be pro-active now in problem anticipation and avoidance and in that vein, has assumed a more prominent role in the Medical Center environment.

3. External Changes

A second philosophical change involved the relationship between purchasing and its vendors. As the interdepartmental partnerships within the hospital emerged, the Purchasing Department began to develop partnerships with its vendors. Two separate relationships needed to evolve; one with the prime vendor and one with the manufacturers, who would distribute their products through the prime vendor. The relationship with the former will be discussed in the following section.

Initial problems were encountered with direct delivery vendors who were asked to distribute their products through the PV. These vendors were concerned that this might result in a loss of control of product representation, substitution, and inventory maintenance in dealing through a competitive distributer. This required orchestrating joint negotiations between the PV and the manufacturers to alleviate their fears and fully educate them on JIT and the benefits of this new relationship. It also meant establishing a long term commitment to these vendors as the primary source of supply for a particular item. Presently, purchasing agents spend time developing long term contracts for high quality items, at a reasonable price, for distribution through the PV. This is in lieu of the time-consuming practice of placing orders with thousands of

vendors. The responsibility to maintain inventory and place orders with manufacturers has been transferred to the PV.

4. Additional Roles

In the ongoing process of quality improvement, the Purchasing Department is the nucleus of many endeavors. These activities include:

1. Recommendations to the hospital Supply Evaluation Committee on new product introduction, product substitution, or the economical conversion of products to the prime vendor.

2. Developing streamlined ordering procedures and mechanisms for user departments. This entailed developing a computer network that consolidated electronic ordering functions for all VUMC departments. As departments order through the network, they receive current contract and vendor price agreements, and a standardized purchase order is placed. Additionally, this system results in electronic invoicing, billing, receipt matching, and payment as this system interfaces with the hospital's financial program.

3. Price and product monitoring to include audit and accounts payable problem resolution.

4. Improve and develop new procedures to evaluate, compare and negotiate with the PV and industry suppliers. This will occur as JIT matures and vendor relationships are firmly established.

E. BAXTER HEALTHCARE-THE PRIME VENDOR FOR VUMC

In starting a JIT program, a hospital must be able to contract with a prime vendor. [Ref. 25:p. 27] However, it is the type of relationship that emerges, between the two, that will determine the degree of success a hospital has with its JIT system. For maximum benefits to be obtained, this partnership must develop into one of mutual trust, where the goals and objectives of each organization are

furthered. [Ref. 26:p. 54] This is the type of relationship that exists between VUMC and Baxter Healthcare.

In developing this partnership, the two organizations had to change from the traditional buyer/supplier arrangement and work together, towards a common purpose. The following are factors required to foster this relationship: [Ref. 26:p. 54]

1. The Prime Vendor Becomes an Integral Member of the Healthcare Delivery Team and a Cooperative Relationship Develops

This is clearly evident at VUMC, as Baxter is intimately involved in the healthcare process. As previously mentioned, monthly meetings are conducted at VUMC. Baxter representatives meet with the nursing staff and materials management personnel to discuss problems, examine new products, look for ways to improve the process, and conduct continuing education. These meetings result in a greater understanding by Baxter personnel, on specific healthcare issues, and how they can assist the hospital in meeting those needs. Likewise, the hospital staff has an appreciation of the abilities and needs of the PV.

These sessions have been instrumental in breaking down communication barriers commonly found in organizations that do not subscribe to the JIT philosophy. The related benefits are achieved as both partners more clearly understand each other's process requirements and how to assist in improving those processes.

2. Clarify the Requirements of Both Parties

To improve the quality of the numerous processes in providing healthcare, the PV and the Materials Management Department must understand and meet each other's needs. They must work together to abolish the adversarial relationship frequently found in a buyer/supplier relationship. In achieving a common goal, VUMC and Baxter shared information, problems, and weaknesses to make a system that would be more responsive to both parties. Several key features demonstrate process improvements:

- The development of custom delivery totes to assure safe, accurate and easy delivery of materials directly to the end-user.
- The development of an assembly line order picking process at the Baxter warehouse. This involved designing specialized shelves for break bulk storage, and installing a conveyer belt system to streamline the filling of orders for direct delivery.
- The creation of a night time delivery program to the nursing stations, thus avoiding interference in the hectic day time work hours. This required Baxter to start a 24 hour operation at its warehouse.
- A sharing of policies, procedures, and contingency plans. Further, they have structured mutual guidelines to handle disaster requirements, liability issues, and access schedules in sensitive areas.

3. Agree on the Methods Used to Evaluate Performance

The only two measures of effectiveness used at VUMC are fill rate and the non-labor cost per patient day. Performance measurement has not been a major issue between Vanderbilt and Baxter, primarily because Baxter delivers

nearly 100% of the material requested on time. Both measures indicate a highly successful program for VUMC and Baxter.

4. Carry the Buyer, Supplier Relationship Beyond the Traditional Boundaries Through Continued Contact Between Key Players

This has become a strong point of the Baxter/VUMC partnership. To ensure continuity within the program and establish a firm relationship, Baxter created a division solely dedicated to the VUMC account. This included the leasing of additional warehouse space to service the unique needs of the JIT program. Members of this division are in constant contact with VUMC personnel. This is readily apparent as the individual in charge of the VUMC account at Baxter spends a significant amount of her time at VUMC. Besides meeting with VUMC logistics staff and/or visiting nursing stations, she is frequently involved in hospital tours. This provides education to other hospitals interested in learning JIT techniques.

5. Establish a Dialogue Between Baxter and VUMC Focusing on Quality Improvement

As the preceding examples illustrate, the relationship between Baxter and VUMC is characterized by a dedication to continually improve the process of providing quality medical care. The ability to have open and frank communication in pursuit of a common goal, allows each party to develop the trust necessary to ensure the success of JIT. This was particularly evident in the beginning stages of the program. On more than one occasion, Baxter was out-of-

stock of an item, partly due to VUMC's inability to accurately predict demand usage. Instead of attempting to lay blame, Baxter pulled out all the stops to obtain the product as quickly as possible and deliver it to Vanderbilt.

F. IMPLEMENTATION DIFFICULTIES

During the past seven years, problems have surfaced in the JIT program that could have been detrimental. However, in keeping with the JIT philosophy, it survived and flourished into the stockless system that thrives today. Two of these problems have been previously discussed: the unanticipated workload in the Accounts Payable Department and the inaccurate demand history provided to the PV. However, three other problems of significance occurred.

One of the most striking problems involved the Purchasing Department, whose workload increased by six times their normal monthly volume. Even though PV decreased the number of vendors used from 2000 to 30, the number of purchase actions per month increased from 1000 to 6000. Initially, a significant amount of overtime was expended to keep current on the procurement volume. This problem was corrected with the proliferation of a computer network enabling users to have direct ordering capability to the PV.

Another problem is that the original prime vendor serving VUMC had difficulties in meeting the specifications of the contract. The contract was eventually canceled and awarded to the secondary prime vendor, Baxter Healthcare. Although this created no major supply disruptions, it points to the

need to develop a contingency plan in the event that the prime vendor program has cause to be terminated.

A final problem is that all manufacturers will not distribute their products through the prime vendor. This problem creates two methods of doing business, and confusion for the end user as to what supplies are available Just-in-Time. Ray Ward indicated that this situation will be corrected this year, as manufacturers become more accepting of this buying method.

G. CHAPTER SUMMARY

This chapter has brought forth the JIT principles from chapters two and three and bonded them into a successful example; the implementation of JIT at VUMC. This was accomplished through three major points. First, JIT inventory practices are effective in improving processes that lead to cost savings, while improving quality. Secondly, new roles, crossing all organizational lines, internal and external to the organization, emerge which require the breaking down of traditional communication barriers to achieve mutual benefits of all concerned. Finally, JIT is more than a set of inventory management techniques; it is a philosophical approach to business operations, to be adopted by everyone in the organization in their approach to and resolution of complex issues.

V. RECOMMENDATIONS PERTAINING TO A JIT SYSTEM FOR NAVAL HOSPITAL, OAKLAND

A. INTRODUCTION

The intent of this chapter is to provide specific recommendations regarding JIT inventory practices to the Materials Management personnel at Naval Hospital, Oakland. One of the primary goals of this discussion is to provoke further thought regarding JIT so that potential transition problems, inherent to new programs, are minimized. In doing so, this chapter synthesizes many of the concepts previously introduced to the reader. These recommendations are intended to provide a basis for further investigation from personnel at Naval Hospital, Oakland.

Some of the recommendations contained in this chapter are more detailed than others. In some areas, the recommendation is purposefully broad in nature to allow the expertise of the personnel at Naval Hospital, Oakland, to decide how the matter is best resolved. It is through the talents, skills, and knowledge of the staff that a well structured JIT program will emerge to address their unique needs.

Prior to examining specific recommendations of a JIT system, it is necessary to discuss the current inventory practices at Naval Hospital, Oakland.

B. CURRENT INVENTORY PRACTICES AT NAVAL HOSPITAL, OAKLAND[3]

Naval Hospital, Oakland, is one of the Navy's premier acute care medical/surgical and teaching hospitals, with a operating bed capacity of 225, and a wartime expansion capacity to 625. Data from February 1992 indicates that the hospital is composed of a staff of 2648 personnel, including 1968 military and 680 civilians. Inpatient care is among the most advanced, including open heart and orthopedic surgery. The average inpatient occupancy is approximately 78%.

The hospital provides extensive outpatient care in the main hospital and in nine branch clinics. These clinics offer a wide array of medical services, with outpatient visits approximating 280,000 annually.

As is quite evident, the material requirements to support these diverse operations are extensive. To meet these needs, the Director for Logistics has four principle departments; Materials Management, Contracting, Equipment Management, and Food Management. This research concerns itself with discussion pertaining to the Materials Management and Contracting Departments (Figure 5-1 illustrates the Logistics Directorate organization).

[3] The information for this section was obtained 30 Oct 92 during a telephone interview with LT Carl Schauppner, MSC, USN, Head, Material Management Department, Naval Hospital, Oakland.

Naval Hospital, Oakland, Logistics Operations
Director for Logistics
Material Management
Material Division
Central Proc/Dist
Stock Control
Customer Service
Contracting
Operations
Purchasing
Receipt Control
Contracts
Equipment Management
Food Management

Figure 5-1.

There is no intention on the part of the authors to suggest that current inventory practices at Naval Hospital, Oakland, are anything other than first rate. In fact, they meet or exceed inventory management measures of effectiveness (MOE) goals established by BUMED. Appendix A contains four MOE's provided to illustrate this point. However, the prime vendor program represents an opportunity to capitalize on new practices that promise to further improve existing operations. It is through PV that JIT techniques can be implemented to meet the increasing demands and responsibilities placed upon material managers.

Materials management operations consist of four divisions; Material Division, Central Processing and Distribution (CPD), Stock Control, and Customer Service. The stock control division maintains 2000 line items of bulk material, using the Medical Inventory Control System (MICS), to control stock levels, order, issue, and receive supplies. This material is ordered via DPSC using Navy Stock Fund monies, and is not the property of the hospital until purchased by an end user. This division includes six item control managers performing inventory functions for specific classes of material.

All material is delivered to the supply warehouse, located a short distance from the hospital. Inventory valued at $3.0 million is maintained in this 25,000 square foot warehouse, representing an average inventory balance of 2.5 months. Orders for warehoused material are purchased by CPD, the wards, and clinics, and routinely delivered to the user within 48 hours, or less.

Central Processing and Distribution functions as an intermediate warehouse located in the hospital. It covers 3500 square feet of space and personnel manage 600 line items of supply. An automated inventory control system called CPD is used for stock accountability and ordering purposes. Approximately $275,000 of inventory is maintained in CPD to support inpatient and outpatient requirements. Figure 5-2 illustrates the flow of material from customer order to receipt.

The Contracting Department consists of eight purchasing agents, supporting the open purchase material requirements of the hospital. Several measures of effectiveness are used to evaluate this department's performance and are illustrated in Appendix B. One of the most commonly cited, and directly affected by JIT, is Procurement Action Lead Time (PALT). This MOE indicates the amount of time since the Purchasing Department received a valid requisition until the order is placed with the vendor. As illustrated in Appendix B, the PALT has shown significant improvement, steadily decreasing from a peak of 20 days in January 1992 to 5 days in August 1992.

The prime vendor contract will be used as an alternative source of supply primarily for open purchased material and some warehouse stock. As the program matures, DPSC's intent is for hospitals to order material from the PV

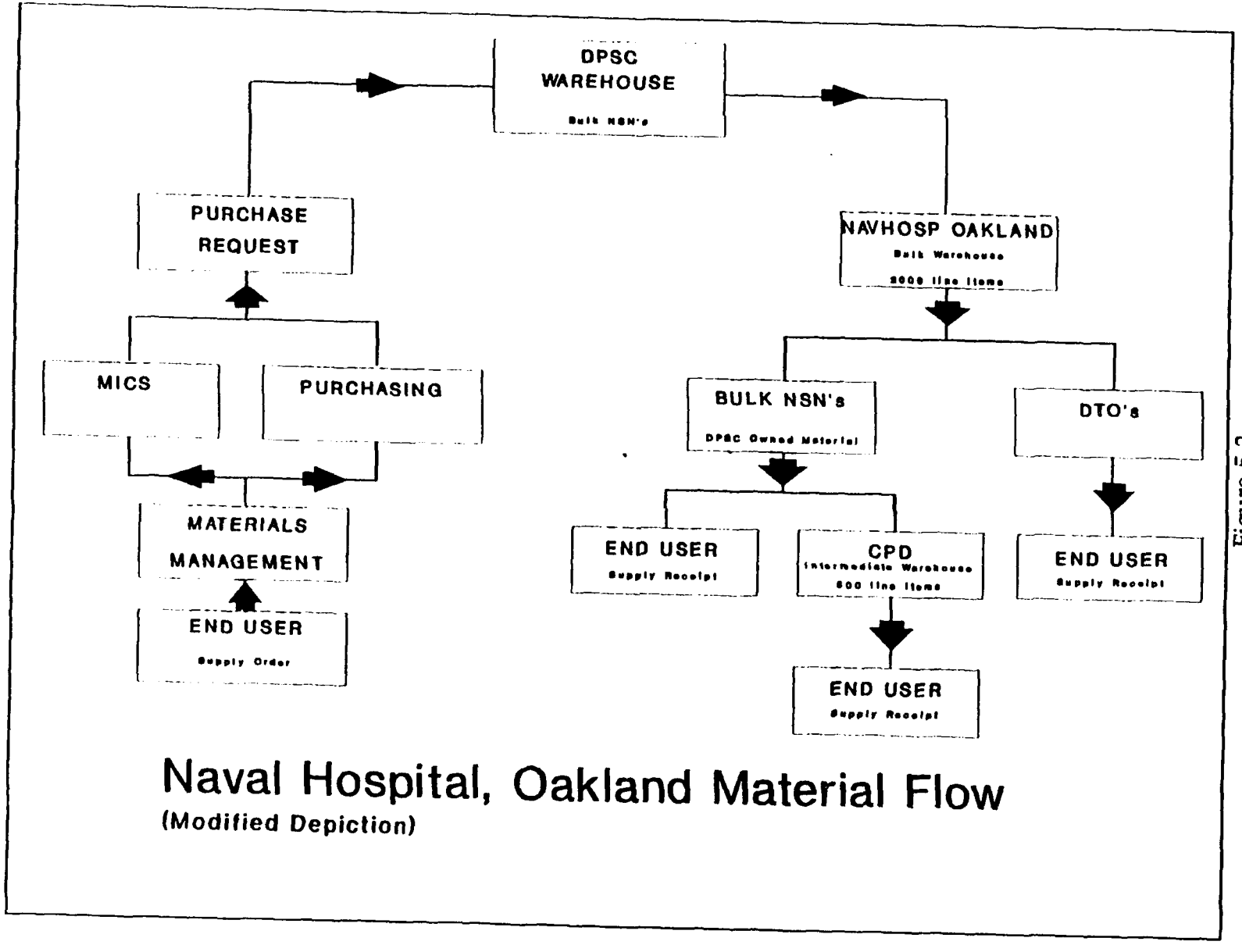

DPSC
WAREHOUSE
PURCHASE
REQUEST
NAVHOSP OAKLAND
MICS
PURCHASING
BULK NSN's
DTO's
DPSC Owned Material
MATERIALS
MANAGEMENT
END USER
Supply Receipt
CPD
Intermediate Warehouse
END USER
Supply Order
END USER
Supply Receipt
Naval Hospital, Oakland Material Flow
(Modified Depiction)

Figure 5-2.

that was previously ordered through the Stock Fund. One of DPSC's long run goals is for the PV to maintain much of the medical inventories presently stocked in the DEPOT's. While the PV program will have an impact in reducing inventory levels, the simultaneous use of JIT techniques will achieve further reductions while improving quality of care.

C. JIT FRAMEWORK

The following is an outline of the areas where JIT recommendations are offered to the Materials Management personnel at Naval Hospital, Oakland.

1. Organizational Considerations

- The change agent.
- Executive and managerial commitment.
- Multi-Disciplinary JIT Working Group.
- Managerial and user education programs.
- Team approach.
- Developing partnerships.

2. Test Site and Supplies Selection.

3. Prime Vendor Contracting.

- Differences between VUMC and DPSC PV programs.
- Collection of baseline data.
- Break bulk on stored material.

- Emphasize continuous quality improvement.

4. Streamline order processing for PV material.

- Small-lot procurement.

5. Receipt and distribution functions.
6. Standardization of material.
7. JIT evaluation criterion.
8. Purchasing's role.

As each of these points is discussed, the principles of Deming and the fourteen elements pertaining to the JIT concept are re-introduced, as appropriate. This reinforces their applicability to the healthcare environment and how they specifically pertain to Naval Hospital, Oakland.

As we progress through this discussion, it must be kept in mind that the ability to implement some of these points is directly dependent on the actions taken to implement others. Ideally, these recommendations should be interwoven and orchestrated to achieve one of the main goals of the Material Management Department; "to support the provision of quality healthcare to the most beneficiaries possible within available resources." [Ref. 9] Table 5-1 summaries these recommendations and provides an implementation priority.

TABLE 5-1. RECOMMENDATIONS FOR NAVAL HOSPITAL, OAKLAND

RECOMMENDATION	VUMC	NAVHOSP OAKLAND	PRIORITY
CHANGE AGENT (CA)	Hospital Administrator who envisioned program; sought commitment.	Director for Logistics; must be committed to the program.	A
EXECUTIVE COMMITMENT	CA worked with top management to inform and educate.	Initiate program to educate CO, XO etc., on JIT.	A
JIT WORKING GROUP	Developed task force year prior to implementation to educate personnel & develop program.	Create multi-disciplinary group to spearhead JIT efforts.	B
EDUCATION	Developed ongoing program to educate all levels of the organization on JIT.	Develop variety of educational programs to communicate JIT philosophy.	B
TEAM APPROACH	Personnel from all areas are vital in delivering patient care. Quality improvement is prime concern.	Form ward units to examine contribution to improve quality care from all areas.	B
DEVELOPING PARTNERSHIPS	The partnership with PV, nursing, material management & purchasing is instrumental to program success.	Must develop close relations with PV, DPSC, & other area hospital personnel.	B
TEST SITE & SUPPLIES SELECTION	Started program on one ward with 18 line items; gradually expanded.	Working group must determine best site and items to phase in program.	C
DPSC PV CONTRACT	PV contract developed over time; changes not inhibited by regulations.	Cannot use VUMC experiences as boilerplate; must develop contract within FAR guidance.	A
COLLECTION OF BASELINE DATA	Began one year prior to implementation; still experienced problems.	Collect data on open purchase requirements as thoroughly as possible.	A

BREAK BULK	Made PV responsible for issuing in units of one.	Must push to order supplies in smallest units possible.	C
CONTINUOUS QUALITY IMPROVEMENT	Elimination of wasteful techniques result in personnel commitment to quality.	Empower all individuals to have ability to correct deficiencies.	B
STREAMLINE ORDER PROCESSING	Created integrated computer network between ward, finance and PV.	Seek methods to reduce PALT; simplify order process.	C
SMALL LOT PROCUREMENT	Buy in quantities to last about 12 hours.	As confidence grows, reduce in-house stocks.	C
RECEIPT AND DISTRIBUTION	Eliminated loading dock; material receipted at ward.	Create criteria to place functions close to user.	C
STANDARDIZE MATERIAL	Reduced number of line items carried; increased quality and space, decreased cost.	Committee to review material needs resulting in efficient resource use.	C
EVALUATION CRITERION	Use two MOE's; fill rate and cost per patient day.	Working group establishes criterion to meet needs.	C
PURCHASING'S ROLE	Instituted JITP goal of long term relationships with vendors.	Adopt JITP philosophy make purchasing key team member.	B

Priority A - Recommendations to be started before implementation.
Priority B - Recommendations to be started after A are in place.
Priority C - Recommendations to be started after B are in place.

NOTE: "A" recommendations lay JIT groundwork, "B" recommendations cultivate JIT philosophy within the organization, and "C" recommendations create functions to develop the program. There is no set implementation order, however, it should fit organizational needs and requirements.

1. Organizational Considerations

a. The Change Agent

RECOMMENDATION: Organizationally, the Director for Logistics should be viewed as the change agent for a JIT system and that the Head, Material Management Department should share in this responsibility.

The organizational culture becomes extremely important in considering the implementation of a sweeping program such as JIT. It is absolutely essential to have an individual completely dedicated to developing a JIT implementation plan. This in turn speaks to the need to develop managerial and user education programs to gradually, and successfully, ingrain the JIT philosophy and concepts into the heart of the organization. The fact that this is a formidable task necessitates that the change agent possess a strong commitment, enduring motivation, and in-depth program understanding. This serves to overcome resistance and resolve problems while attaining program objectives. Until personnel in the hospital are convinced of the merits of JIT, the full potential and benefits of this system will not be realized.

Ideally, the change agent is an individual with sufficient autonomy and influence who can propose alternatives consistent with the goals of the organization. [Ref. 23:p. 77] In the military, this is not always accomplished as many new programs emanate from higher authority and personnel are assigned program management and responsibility along positional lines and rank. By itself,

this does not hinder successful program management, however, greater success is achieved if the individual has a strong commitment to the program. The ultimate goal is to have an officer with sufficient vision manage a promising program and develop its full potential for the benefit of the organization. To be fully effective, this individual must be cognizant of the social and political arena, understand the attitude and beliefs of the players involved, and meld the organization's goals consistent with the JIT philosophy. [Ref. 27:p. 37]

At VUMC Ray Ward and the Associate Administrator for Support Services possessed both the positional autonomy and program commitment to direct the change to JIT. Positionally, Mr. Ward was able to achieve top executive commitment, and possessed the management dynamics to maintain support from his subordinates in instituting JIT. The Associate Administrator, in turn, orchestrated the actual implementation, sustaining a high level of program motivation throughout the organization.

At Naval Hospital, Oakland, the change agent's responsibility rests primarily with the Director for Logistics. Organizationally, this position possesses the autonomy and influence necessary to fulfill this role. Together with the Head, Materials Management Department, they should possess the necessary program knowledge and motivation to adopt practices which prove beneficial to the organization. Much of the success of a JIT initiative depends on the sustained motivation and commitment of these individuals and their ability to impart these characteristics to the senior managerial levels.

b. *Executive and Managerial Commitment*

RECOMMENDATION: The change agent should institute a program to educate senior leadership on the benefits of JIT. This should be an on-going effort, updated with current information as JIT develops over time.

Any new program of sufficient magnitude requires the initial and sustained commitment of senior executives and managers within the organization. However, all too often the initial commitment is obtained, but the focus is soon lost because efforts are not expended to ensure a long-term commitment. This is a crucial area of involvement for the change agent.

For senior management to remain committed to JIT: 1) the program goals and objectives must be clearly articulated, 2) frequent planning updates must be provided, and 3) problems must be promptly resolved and the results reported to the senior leadership. Changes to a program are normal and necessary since the organization is a dynamic entity and planning cannot encompass all events. Senior leadership will respond favorably to program modifications, but only if they are advised of planning details in advance and not caught off-guard by unannounced "surprises" or changes to the program.

This proactive communication serves to involve everyone in the planning stages and courts agreement, even among potential opponents, on program goals and objectives. Although JIT is only one program within a complex organization, this is the essence of point one of Deming's philosophy; that is to create a constancy of purpose toward improvement of product and service. JIT

can serve as a beginning in promoting this attitude. As it permeates the organization, this philosophy will become ingrained in the organizational culture, as Deming had envisioned.

c. Multi-Disciplinary JIT Working Group

RECOMMENDATION: The change agent, with inputs from senior leadership, shall establish a working group with representatives from various areas within the hospital to develop a strategy to implement JIT.

A JIT system, unlike many other new programs, requires wholesale participation and planning efforts from individuals throughout the organization. This is because supply issues have a significant impact on the delivery of quality patient care, and the impact is felt across all organizational lines. Although a change agent provides much of the direction and motivation to the program, other personnel must be brought into the early planning stages to ensure that all viewpoints are considered. These individuals should represent a cross-section of the organization. The following list is provided as an example of the disciplines that have interest to a JIT program, and should be expanded as appropriate:

- Nursing Service
- Pharmacy
- Administration
- Purchasing
- Finance
- Stock Control

- Receipt Control
- Materials Management
- Accounts Payable
- Customer Service
- Information Systems
- Central Processing/Distribution

Undoubtedly, many of the individuals in these disciplines will possess certain reservations pertaining to JIT practices and/or the prime vendor program. Fear serves as an impediment to open discussions and must be addressed. Team-members must be assured of the value of their contributions and the importance of the program to the organization.

As planning evolves, the need may arise to form sub-committees to investigate specific areas and report their results to the JIT Working Group. This serves two purposes: 1) it fosters "ownership" of the JIT concept among the participants as subject matter experts are created and, 2) it empowers people to make recommendations and resolve problem areas.

VUMC used these committees extensively in developing the implementation strategy for their program. An atmosphere was created that encouraged open dialogue and the free exchange of ideas. These committees were formed approximately one year in advance of program implementation. It was felt that this amount of time was needed to reduce uncertainty and instill the JIT

philosophy. After the working group and various sub-committees are established, the development of managerial and user education programs must be considered.

d. Managerial and User Education Programs

RECOMMENDATION: Establish education programs targeted at the user level to inform personnel of the JIT program, its intentions, merits, and their contributions to its success. The goal is to reduce uncertainty and eliminate fear.

Rumors run rampant with any new program. This only serves to confuse program direction, erode motivation, and create fear and uncertainty. Managerial and user education programs, aimed at the very people who will most often interact with a JIT system, must be established early in the program planning stages. Communication can be impeded by barriers that exist among healthcare professionals. Our research at VUMC revealed, that prior to JIT, distinct departmental barriers existed that inhibited effective communication. These barriers have been almost entirely eliminated as the JIT educational efforts have resulted in more open communication.

Deming's point nine stresses the need to eliminate departmental barriers. This can be accomplished through education programs that are informative, informal, and modified as necessary to educate personnel on the "nuts and bolts" of the program. Even in periods of uncertainty, education is an important tool in fostering teamwork and cooperation.

While the Materials Management personnel will bear great responsibility in staff education, the members of the JIT Working Group should share in this effort. These subject matter experts can impart their knowledge and gain insight from questions posed by the users. In turn, user departments have an equal responsibility to educate others on their requirements and concerns.

A variety of forums exist, and should be used, to communicate information to the staff. Deming's points six and thirteen advocate the need for rigorous training and education programs, and the need to institute modern methods of training on the job. This suggests that different methods, and means, be used to convey information. "Brown bag" lunches, informal meetings, and question and answer sessions are among a few. The success of these programs depends on the quality of the program and the information conveyed. The "presentation" must not become mundane, for interest will wane rapidly. If this occurs, it will be difficult to re-vitalize program interest. To avoid program complacency topics must be kept short and relevant, methods of presentation must be varied, and the most up-to-date information must be conveyed.

Despite the necessity for education programs, there is no substitute for impromptu discussions that occur *in the user work area* by a key manager. As the Head, Materials Management Department, visits the areas targeted for JIT, he should purposefully engage in conversation about the program. This imparts a genuine level of concern for the user's input and establishes "face recognition" to an otherwise impersonal program.

Ultimately, the goal of this aggressive education program combined with personal contacts is to counter conflict, keep personnel abreast of changes to the program, and build a healthy, trusting rapport among all the staff members. Much of the success of JIT depends on a strong, cohesive team resolving problems as they occur.

*e. **Team Approach***

RECOMMENDATION: Inpatient areas must strive to develop cohesive units where all personnel providing services to that unit feel personally responsible for the quality of care delivered to the patient.

Deming's point nine and the use of quality circles are relevant to this recommendation. The emphasis is for all personnel to become personally responsible for a quality outcome and to work harmoniously toward that goal. Group technology suggests that personnel from various units be viewed as a collective whole in providing a particular service. The same is true for quality circles. In the provision of healthcare, custodians, food service employees, administrators, supply personnel, and nursing service personnel should join together to continuously improve the quality of operations.

One of the primary methods in developing a cohesive staff, is to form small work units on each ward. These specialized groups are reflective of the need to develop quality circles. They should be comprised of personnel who provide the entire range of patient related services. Small interactive groups foster

a working relationship where all personnel freely contribute their ideas to improving patient care.

A key feature of VUMC's program is its Ward Service Centers. Currently, at Naval Hospital, Oakland, Hospital Corpsmen assigned to each ward perform supply duties. Each Corpsman's responsibilities differs somewhat, and continuity is a large concern. In addition, although these Corpsmen impact the supply system, they are in no manner accountable to the Materials Management Department.

If Oakland were to consider a program similar to VUMC's Service Centers, the responsibility of, and accountability for, these Corpsmen must be reviewed. They should become directly involved in daily patient care as this knowledge will be beneficial in predicting supply needs.

f. Developing Partnerships

RECOMMENDATION: The Head, Materials Management Department is to be the primary liaison officer for JIT concerns between the hospital, the prime vendor, DPSC, and other area hospitals.

As stressed throughout this research, the building of a strong relationship with the PV is absolutely paramount to the success of JIT. For Naval Hospital, Oakland, this task is further complicated because of the involvement of other organizations, namely DPSC, and other hospitals supported by the PV. While these multiple organizations increase the complexity of developing partnership arrangements, this is offset by distinct advantages, such as

significantly reduced administrative contract burdens. While difficult, it is possible to create a mutually amiable and beneficial relationship among all parties.

The Head, Materials Management Department, should develop a close working relationship with DPSC in the early stages of contract negotiation. He/she should endeavor to assist contracting personnel in structuring a contract that is in the best interest of Naval Hospital, Oakland. While DPSC will solicit the hospital's input, early contact with them will go far in acquiring information and ensure informed input to the contracting process.

While VUMC has no difficulties in discussing any aspect of a proposed contract with prime vendor candidates, the government has stiff regulations concerning this practice. Care must be taken in approaching potential bidders with too much information. DPSC should be consulted before contract requirements are released. However, these guidelines should not preclude *all* discussions. The hospital staff has a certain responsibility to invite early dialogue to ensure that vendors have an appreciation for the unique aspects of the program.

Once a contractor is selected, earnest discussions should occur at both the hospital and the PV's organization regarding specific contract requirements. Each party should thoroughly understand the other's responsibilities and establish a clear understanding of any potential areas of dispute. Once these are resolved, the PV should have periodic meetings with interested hospital personnel to resolve any problems first-hand. There is virtually

no limit to the amount and type of personal contacts that should occur. The goal is to develop a cordial relationship that promotes an atmosphere of general concern for each other's welfare. When this is achieved, problems will be settled much more easily and will benefit the quality of care.

Finally, the fact that many hospitals can use the services of the same prime vendor represents a tremendous source of information, clout, and supply availability for the materials management personnel at these hospitals. In addition, this is an excellent opportunity to discuss JIT initiatives with other material professionals. Naval Hospital, Oakland, should develop a strong relationship with these hospitals in the early program stages in order to capitalize on this source of information and power. Since many of these hospitals, including Naval Hospital, Oakland, now meet regularly to discuss tri-service logistics issues, this relationship only needs to be further strengthened, based on a mutual interest in the PV program.

It is through earnest discussions with the PV that the framework is established for a long term relationship. This long term relationship is the foundation for a partnership that integrates the PV into the healthcare delivery team.

Having discussed many of the recommendations pertaining to the program commitment and team building, the JIT Working Committee must weigh various options in deciding how to implement the PV program. Alternatives

include whether to implement the program throughout the hospital, or in a few select locations. The following discusses the latter option.

2. Test Site and Supplies Selection

RECOMMENDATION: Select a limited number of supplies and inpatient areas and incrementally implement the prime vendor program and JIT techniques as confidence builds in the system.

VUMC started their PV program on one ward with 18 line items of supply. Following VUMC's experience, it behooves the working group to consider phasing in the prime vendor program and JIT techniques gradually. This allows "bugs" to be worked out on a small scale before they become insurmountable. It is far better to start somewhat slowly and build a viable program rather than wide-spread implementation that lacks sufficient control. In this manner, personnel are apt to be more personally involved in getting the program started. It must be remembered that, as with VUMC, the ability to rapidly expand the program is possible while the reverse is not.

No attempt will be made to suggest the "right" number of wards or lines of supply items that is optimal to begin a JIT program. This depends on factors best evaluated by the Director for Logistics and Head, Materials Management Department. These factors include the complexity and configuration of the wards, the degree of expected program acceptance by the ward staff, and past experiences with supply related issues. The choice should be predicated on

the ability to adequately exercise control over each order, using supplies that are not critical to patient care.

3. Prime Vendor Contracting

One of the goals of JIT is to reduce leadtime variability in the receipt of material, thus enabling less material to be carried by the hospital. Aside from safety stocks, inventories represent waste and are costly to maintain. Factors such as obsolescence, storage, pilferage, and vandalism add no value to the product and should be eliminated. The resulting cost and space savings can be substantial. Naval Hospital, Oakland, has 28,500 square feet of space devoted to inventory storage, excluding storage spaces in the inpatient care areas. By transferring the storage responsibilities of even a portion of inventory to the prime vendor, space requirements will decrease and result in more simplified operations at a reduced cost. In addition, this storage space can be converted to more productive purposes.

VUMC has proven that JIT techniques offer improved inventory operations at a reduced cost. However, VUMC and Baxter Healthcare work in an environment that is very different from that of Naval Hospital, Oakland, and their yet-to-be-named PV. The next section discusses some of these contractual and environmental differences.

a. Differences Between VUMC and DPSC PV Programs[4]

RECOMMENDATION: Fully understand the differences between the VUMC and DPSC prime vendor programs. This is essential in order to articulate variations in anticipated outcomes.

The following are differences between the VUMC and the DPSC prime vendor programs:

- One Versus Two Prime Vendors.
- Delivery Scheduling.
- Contractual Restrictions.
- Financial Considerations.
- Integrated Computer Support.

It is important to understand these differences and how they affect program flexibility since comparison of expected benefits between VUMC and Naval Hospital, Oakland, is likely. This is not to say that significant benefits will not accrue to Naval Hospital, Oakland. However, these differences account for changes in how the two programs will operate and, thus, may affect the anticipated program benefits.

[4] The basis for this discussion are documents furnished by VUMC and a proposed Statement of Work obtained from DPSC on October 9, 1992.

(1) One Versus Two Prime Vendors. VUMC has a contract with one prime vendor, Baxter Healthcare, to furnish all medical/surgical and pharmaceutical supplies. A second prime vendor exists, but is typically used only in emergency situations. Naval Hospital, Oakland, will have two prime vendors; one for medical/surgical supplies, and one for pharmaceutical supplies. This, in itself, does not dampen the benefits of a JIT program. It does, however, reduce the negotiation leverage of the hospital. Obviously, Baxter Healthcare has made a tremendous investment in supporting VUMC and, thus, has a vested interest in ensuring the success of the program. While Naval Hospital, Oakland's prime vendors will also undoubtedly have a significant investment in the program, it will be to a lesser degree than Baxter Healthcare, and flexibility on the part of the hospital will be somewhat less.

This is countered, somewhat, by the fact that the prime vendors supporting Naval Hospital, Oakland, also provide support to other large medical facilities in the vicinity. This represents a significant buying power on the part of the hospitals, if managed effectively. As previously discussed, it is beneficial for the area hospitals and the prime vendors to meet frequently to share concerns, ideas, and desired courses of actions. In developing a lasting relationship that strives to attain continuous product quality, it is in the best interests of the hospitals and the PV to resolve issues to their mutual satisfaction.

(2) *Delivery Scheduling.* VUMC requires its PV to deliver supplies seven days per week, including holidays. This ensures that minimal supplies are maintained at the hospital, and shortages are virtually eliminated.

The DPSC Statement of Work provides for delivery of supplies within 24 hours of order placement, Monday through Friday, between the hours of 8:00 A.M. and 5:00 P.M. No deliveries will be scheduled for holidays, and orders received on Fridays will be delivered on the following Monday. These contract requirements *may* necessitate modification after experience with the prime vendor program. The goal is to reduce leadtime variability by conforming to a consistent delivery schedule. The key is to enhance contractual requirements for the benefit of all parties involved, within the scope of Federal Acquisition Regulations.

The delivery schedule in the proposed Statement of Work necessitates that hospital staff be more aware of approaching supply requirements to avoid stock outages. They must order in greater quantities to cover supply needs for longer periods than at VUMC.

It may be beneficial to structure a delivery schedule that can be tailored to meet the needs of the PV and the hospital as experience with the program grows. Since the prime vendor is servicing several hospitals, it may be more convenient to schedule evening or Saturday deliveries. In addition, the hospital and the PV may wish to establish a consistent time when deliveries will occur. In a JIT system, it is desirable to eliminate *any* variation in the process. The

point is to develop a relationship that improves processes to meet the needs of the hospital and the PV.

(3) Contractual Restrictions. The primary distinction between the contractual requirements of VUMC and DPSC is reduced flexibility. While manageable, the added governmental regulations that are inherent to the DPSC contract serve to reduce Naval Hospital, Oakland's, ability to adjust to changes that arise as the program matures. This is by no means detrimental to a JIT system; it only requires that the materials management staff be more vigilant in resolving problems promptly.

In general, VUMC and Baxter can add services to the contract, as they deem necessary. For example, originally VUMC required supplies to be delivered to the hospital loading dock. They later changed this specification to have supplies delivered directly to the user, and the number of sites rapidly increased. This was accomplished easily and quickly as both parties agreed to the change as necessary for the growth of the program.

Contract changes, depending upon the magnitude, are not accomplished locally. In most cases, a contracting officer is require to effect the desired change. For example, adding delivery sites is a change to the contract specifications that would require a formal modification. Therefore, it is imperative that the hospital's requirements and the limits of the contract are clearly understood by all parties before the program is implemented.

(4) Financial Considerations. Financial differences between VUMC and Naval Hospital, Oakland, exist primarily for two reasons. First, Naval Hospital, Oakland, has greater difficulty in allocating resources for new projects or materials that have not been previously programmed into the budget. Secondly, fiscal fluctuations and year-end buying circumstances faced by Naval Hospital, Oakland, are unique to the government.

VUMC has the ability to channel resources expeditiously into projects that offer increasing cash flow or improved profitability. In improving their JIT processes, VUMC has expended resources for standardized supply containers and remodeling certain patient care areas to increase the ease in unit dispensing. While these were planned for in advance, it is a much more casual planning process than faced by Naval Hospital, Oakland.

A key feature in reducing inventory is to ensure a continuous stream of material, in small lot sizes, flows into the organization. The governmental budget process, periodically, disrupts material flow. This is particularly true at the start of, and close of, a fiscal year. In the former, sustained material flow can be disrupted when the budget is not passed on time and funding is received incrementally. In the latter, resources can become extremely limited, and in some cases, buying is halted altogether, as funds diminish.

The creation of a sub-committee to the JIT Working Group should examine how funds can be allocated more evenly during the fiscal year

to resolve this dilemma. The goal is to channel increased cash flow from a reduction of supplies to other projects in the hospital.

(5) Integrated Computer Support. During the past several years, the computer support at VUMC has grown into an impressive, integrated system. It performs inventory management functions and creates a charge to a patient's bill when material is expended. This sophisticated system streamlines control of the JIT program and provides the necessary management information to track the progress of supply orders and detect problems before they reach a critical stage.

VUMC has placed computer terminals in every Service Center and tracks material receipts and issues, and retains equipment data, such as location and preventive maintenance information. The service center staff has access to an on-line, real-time, information management system.

The proposed Statement of Work (SOW) for Naval Hospital, Oakland's, prime vendor stipulates that the selected contractor will furnish software to each hospital for ordering, receipt, and billing purposes. The issue of hardware is unclear at this point. One DPSC document seems to indicate that the PV will provide two terminals, while the latest SOW implies the hospital's existing personal computers will be used. This issue will undoubtedly be resolved prior to a formal solicitation notice. This presents an excellent opportunity for the Materials Management staff to have input in this matter.

A second issue requiring resolution is the manner in which the PV's system will interface with MICS for ordering, stock accountability, and

inventory purposes. In the SOW, the services of a separate contractor will be sought to establish this computer link. This process must be carefully followed by hospital personnel to ensure that the ultimate interface provides the information needed by the materials management staff.

A third issue to consider is the number of ordering sites that will be possible within the hospital. This becomes a particularly important issue if the hardware is to be provided by the PV. The implementation team must be able to envision the extent of the system required throughout the hospital and equate that to the number of ordering sites and their locations. However, experience will be the true barometer, and the system must remain flexible enough to accommodate future changes. This situation must be closely monitored by the working group. Equipment up-time, amount of usage, and the potential backlog of information flow will determine the need to modify equipment requirements in future contract specifications.

b. Collection of Baseline Data

RECOMMENDATION: Begin as soon as feasible to collect demand information on open purchase material. Consult the Purchasing Department for suggestions on how to accomplish this task.

The importance of starting a JIT program with good demand history cannot be overemphasized. Despite a systematic, year long effort in this endeavor at VUMC, supply shortages occurred in the initial stages of the program. A similar circumstance occurred in a JIT program at UCLA. Their JIT

vendor stocked minimal levels of supplies based on inaccurate usage data, causing frequent shortages and a high level of frustration for several months. [Ref. 28:p. 26]

There is little doubt that Naval Hospital, Oakland, will begin a JIT system with less than desirable material usage history. Personnel at all levels are instrumental in providing the required information to ensure the best demand history is obtained.

The evidence is clear that this information is critical in the early stages of working with a PV. However, no written guidance has been provided to Naval Hospital, Oakland, as to what data needs to be collected. This could lead to an extremely difficult start-up, as the PV may not have sufficient stock to cover demand. This problem will be compounded by the fact that the PV is servicing several other hospitals in the area. However, certain steps can be taken by Naval Hospital, Oakland, personnel to avoid material shortages by the PV, due to inaccurate usage information.

First, ensure that personnel at all levels in the organization are well aware of this typical problem. There is no reason to hide the fact that material shortages may occur, since this appears to be a predictable outcome in the early stages of adjusting to a new system. If personnel are prepared for this event, they are much more likely to resolve it with minimal frustration.

Second, existing stocks can be reduced very slowly. This material can be used as safety stock until it is assured that the PV has sufficient inventory to handle most demand changes.

Lastly, frequent communication with the prime vendor is never more critical than at the early stages of a JIT program. The Head, Materials Management Department, should ensure that the prime vendor is aware of anticipated material shortages with enough leadtime to correct the deficiency. Likewise, the PV must communicate to the hospital when it appears that a shortage will occur. This two-way communication will go far in resolving problems before they escalate.

c. Break Bulk on Stored Material

RECOMMENDATION: Push the PV to break bulk in his warehouse. Constantly strive to have as little material on the wards as possible. Preferably, this means issuing items in units of one. The same concept applies to CPD and the warehouse.

Break bulk is a technique where material is issued in the smallest unit feasible, rather than the usual practice of case lot issuance. This reduces waste and eliminates shelf life expiration concerns. In addition, more accurate demand information is obtained because material is ordered as patient demand dictates.

The ultimate goal is for the prime vendor to break bulk in his warehouse, thus, transferring bulk storage and handling responsibilities to the PV. This reduces inventory storage, labor, disposal and other overhead costs. While

this may be possible on some items, it may not be feasible on others. This must be a joint decision between Naval Hospital, Oakland, and the PV.

As a final advantage, break bulk allows for the early detection of defective and/or damaged material. With a minimal amount of available material, poor quality items cannot be overlooked. When a defective or damaged item(s) is discovered, the material must be replaced, by the PV, immediately since there is no buffer stock available. This process will quickly signal that there might be a quality issue concerning a certain lot or manufacturer.

For those items that must be delivered to the hospital in bulk, internal procedures aimed at issuing items in the smallest quantity possible should be instituted. This will go far in saving space, cost, and time.

d. Emphasize Continuous Quality Improvement

RECOMMENDATION: Empower all personnel in the organization to take action when process problems or material deficiencies arise.

JIT emphasizes that all individuals be involved and have an impact in improving processes, in our case, the delivery of healthcare. This involves personnel within the hospital and the PV. Further, JIT emphasizes that long-term relationships, focusing on quality improvement, be established between buyer and supplier. Oakland must develop this type of relationship with their PV; one that is not based solely on price. Should quality defects arise, and they will, materials management personnel and the PV must ensure that they are resolved promptly.

This point is the essence of Deming's point four; to ensure that suppliers provide products of increasing quality.

In JIT, the practice of accepting material with defects is not tolerable, for it contributes to waste and needless expense. JIDOKA takes this point one step further by advocating that all personnel who use material have a responsibility to "stop" the process if defective material is detected. It is through education and team-building that fear is replaced by trust, and individuals are empowered to correct deficiencies.

4. Streamline Order Processing for Prime Vendor Material

RECOMMENDATION: Establish a central order site, such as CPD, for the medical/surgical supplies covered under the prime vendor program.

JIT seeks methods to streamline ordering processes reducing administrative leadtime. The prime vendor program is a tool that enables leadtime to be reduced, depending on how the ordering process is structured.

Since the primary customers are the wards, it makes sense to locate the ordering site close to the users. This enables the ward supply personnel to easily and rapidly deliver their material requests. This frequent contact between ward supply personnel and materials management personnel, will also increase rapport and prevent problems through routine discussions. Locations for consideration are CPD, Stock Control, or Purchasing.

Regardless of site location, the ordering process should be simplified as much as possible. The key is to reduce the number of personnel that must

handle the order prior to being placed with the PV. Ideally, orders should be brought directly from the wards to the order site and processed immediately. All procedures necessary to place the order should be accomplished on site, including technical review. Once order confirmation is received from the PV, ward personnel can be notified of any deficiencies and efforts can be undertaken to correct them.

a. Small-lot Procurement

RECOMMENDATION: Make a conscious effort to continually increase order frequency from the PV and reduce inventory levels throughout the hospital.

One of the most significant advantages of JIT, offered by the prime vendor program, is the ability to frequently procure material in small quantities. This serves to reduce inventory levels, decrease space requirements, and eliminate waste.

Initially, orders with the prime vendor will be larger than necessary. As confidence grows in the prime vendor's ability to furnish supplies as specified, then inventory levels can be reduced. CPD should take a proactive role in assessing material needs and take efforts to reduce inventory.

In addition, a significant amount of material is maintained on the wards. This is a normal response to the traditional Just-in-Case inventory management system. Supply should establish a program to work with the users in aggressively reducing the material stored on the wards. To ease transition concerns, it may be possible to establish a central location to temporarily maintain

a limited amount of safety stock. This material will be comprised of the consolidated material from the wards. As user confidence in the system grows, this supply area can be eliminated.

5. Receipt and Distribution Functions

RECOMMENDATION: Establish objective criteria to evaluate the best location for receiving and distributing materials purchased from the PV.

One of the considerations of a JIT program is determining the best location to receive and distribute material received from the PV. These sites do not necessarily have to be the same, although one site will ease coordination problems. A PV can deliver to multiple sites, if specified in the contract. For example, the VUMC prime vendor delivers to 650 sites, encompassing the hospital and outpatient clinics.

For Naval Hospital, Oakland, delivery sites should be as close to the user as possible. Possibilities for receipt and distribution of medical/surgical supplies include the ward, the warehouse, and CPD. Whatever site(s) is selected, qualified Materials Management personnel must be available to certify delivery.

Criteria to select the best site among the possibilities include; 1) amount and type of material to be processed, 2) space requirements, 3) minimal handling of supplies, 4) whether most of the material is to be delivered immediately to the ward or placed in stock, 5) convenience to the customer and, 6) receipt functions to be performed. The JIT Working Committee is likely to develop other criteria. The key is to logically select the best location according to the established criteria.

JIT emphasizes delivering the exact quantity of supplies directly to the user as they are needed. While this is the optimum goal, it is doubtful that Naval Hospital, Oakland, will undertake direct deliveries to the user (the ward) initially. Nevertheless, this is a possible future course of action, and plans should be developed accordingly.

Since the PV will deliver a small quantity of supplies daily, the end user must receive their material expeditiously to avoid stock-outs. In order to minimize handling and the resulting leadtime, supplies should be delivered as close to the user as possible. As CPD is located in the hospital, adjacent to a loading dock, it appears to be the best choice as a delivery location. This minimizes handling requirements once the material reaches the hospital. In addition, CPD is staffed by material management personnel familiar with receipt and distribution functions. Finally, if material is received from the prime vendor and marked as to final destination, then CPD can arrange for ward supply personnel to pick up the supplies, saving on further delivery. This saves time and expedites receipt to the ward.

Although this research is intended to only focus on the inpatient care facilities at Oakland, the clinics outside of the hospital's compound need to be addressed. The working group must consider the requirements of the clinics prior to a final decision on the establishment of this site.

6. Standardization of Material

RECOMMENDATION: Establish a committee to include a Physician Advisor, Nursing, Pharmacy, Material Management, Finance, Purchasing, and Prime Vendor personnel, whose purpose is to standardize material used throughout the hospital.

Standardization of material accomplishes three primary goals. First, it simplifies the ordering process since fewer line items need to be procured. This, in turn, reduces the amount of space necessary to store material in the hospital. Second, users become familiar with fewer brand items reducing the set-up and usage time. This enables personnel to pursue other patient care responsibilities. Third, standardization allows the prime vendor to focus its inventory management concerns on fewer line items. This simplifies the PV's overall responsibilities and increases product quality since more time can be devoted to quality concerns of fewer products.

The role of this committee is very important. Their efforts will translate to reduced material space requirements and costs for the hospital. For this committee to have the desired effect, a critical evaluation of each new item request must be undertaken and the financial implications evaluated. If new products replace other items, then materials management must ensure the replaced item is eliminated from inventory. With PV, this is a relatively simple task since less material exists to be phased out.

A secondary benefit derived from standardization is the development of a partnership with the PV. As the PV and the committee work together to resolve issues, a better appreciation of each other's capabilities will develop. The prime vendor is aware of quality aspects with supply manufacturers and can inform the committee of potential concerns. The partnership formed under JIT now has a direct impact on improving product quality.

7. JIT Evaluation Criteria

RECOMMENDATION: The JIT Working Group should develop simple, quantitative data to evaluate the effectiveness of JIT.

The prime vendor program, as part of the contract, has specific evaluation criterion to assess the performance of the contractor. Other evaluation criteria may need to be established to assess the effectiveness of JIT techniques that are mutually agreed upon by the hospital and the PV.

The indicators serve as a structured approach in measuring the progress toward improving quality in the JIT system. In addition, they reduce emotions in the evaluation process, and enable personnel to focus on the intended outcome rather than the people or the issues that are involved. [Ref. 26:p. 58]

8. Purchasing's Role

RECOMMENDATION: The Purchasing Department needs to examine its current practices and modify them to incorporate JIT purchasing techniques, to the maximum extent possible.

This process will involve three steps: 1) adopt the JITP mindset: fewer suppliers, smaller lots, increased quality, 2) strengthen working relationships within the hospital, and 3) develop new partnerships with organizations external to the hospital.

The Purchasing Department is an extremely important cog in the JIT process, and as such must wholeheartedly endorse the philosophy. The traditional basis of government purchasing is to establish contracts, usually for large lots, at the lowest price possible. This technique often leads to conflicts between the vendor and the government, as the government pits one vendor against the other in pursuit of the minimum price. In addition, quality is not necessarily the primary consideration.

JIT purchasing requires that material be purchased from the same vendor, in small, frequent quantities, with quality taking precedent over price. Purchasing personnel need to acquire methods to institute these practices.

As with VUMC, the relationship between the purchasing agents at Naval Hospital, Oakland, and the medical staff can be strengthened through mutual participation in the procurement process. Through educational endeavors and team meetings, a partnership must develop between the two, which leads to the common pursuit of providing quality healthcare.

Lastly, the Purchasing Department must develop a bond with the prime vendor and the manufacturers that will be distributing their products through the PV. This relationship will be harder to develop than was the case at

VUMC because of complex government regulations. However, this should not preclude Oakland from seeking innovative ways to strengthen their ties to these vendors and build partnerships to make JIT more effective. With streamlined purchasing techniques, purchasing agents can devote more time to buying higher quality products from fewer suppliers.

D. CHAPTER SUMMARY

This chapter provides specific recommendations pertaining to a JIT program to the Materials Management personnel at Naval Hospital, Oakland. These recommendations are intended to provide personnel with an insight into the extensive nature of a JIT program. In considering these points, they must assess them against current circumstances to determine which ones are applicable in structuring the most beneficial JIT program.

VI. CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDY

A. INTRODUCTION

The focus of this research was to examine the Just-in-Time inventory management philosophy for its application to inventory management practices at Naval Hospital, Oakland. In order to make that assessment this research:

1. Provided a brief history of JIT and presented the underlying principles of the philosophy.

2. Examined how JIT can be modified from the production industry to the healthcare industry. This transition was illustrated using the highly successful program at Vanderbilt University Medical Center (VUMC).

3. Outlined specific implementation details of the JIT program at VUMC. This analysis emphasized that JIT is not a set of techniques to be copied—but rather a philosophy to be incorporated into daily business practices.

4. Developed recommendations for Naval Hospital, Oakland, to consider as they pertain to a JIT system. The emphasis is on an individual carrying the JIT banner, and developing a program based on commitment, team building, and education.

B. CONCLUSIONS

1. The Just-in-Time philosophy leads to improved product quality and cost savings through: waste reduction, process improvements, and a respect for human resources.

The resurgence of the Japanese production capabilities, particularly in the electronic and automotive industries, has its roots in the JIT philosophy. By dedicating themselves to using minimum resources, reducing setup times, and placing quality production in the hands of the worker, Japanese products are considered to be of the highest quality in the world.

2. *The JIT philosophy can be successfully adapted to the healthcare industry.*

As VUMC has clearly demonstrated, JIT principles can be converted for use in inventory management operations in the healthcare industry. The result is significant cost savings, the elimination of duplication of effort, and a more efficient use of space. At the same time, the quality of patient care is improved through; 1) an increase in nursing time that can be devoted to direct care responsibilities, 2) development of a team approach to delivering healthcare, and 3) a more efficient use of medical supplies that emphasizes quality improvement.

3. *A Just-in-Time program cannot be developed solely through the prime vendor initiative.*

While both the prime vendor program and JIT purport to reduce inventory levels and subsequently costs, JIT encompasses an organizational perspective that achieves far greater efficiencies than prime vendor. Its benefits work toward reducing organizational barriers, and replacing traditional mindsets and relationships. This new approach in resolving issues strives to improve the quality of services provided in every area and maximize the use of available resources. Prime vendor is essential in developing the initial momentum to

eliminate waste, but JIT employs methods to complement, and further the goals of prime vendor.

4. *Just-in-Time inventory practices can be adopted at Naval Hospital, Oakland.*

Many challenges will be addressed by personnel at Naval Hospital, Oakland in developing a JIT system. These include FAR regulations, integrated computer support, funding issues, and maintaining commitment as the program matures. But each of these can be successfully faced in structuring an inventory management system that meets the needs of the coming decade.

The key to a viable program is comprehensive planning and the early involvement of personnel in understanding the JIT philosophy. It is through a comprehensive education program that people will recognize the benefits of more efficient inventory management and begin to incorporate the principles of JIT.

5. *A JIT program is a long-term initiative.*

JIT is not a short-term initiative, nor can it be implemented without detailed planning. Personnel at all levels must understand that their sustained efforts are vital to the success of the program. The change agent is instrumental in guiding the actions of others toward achieving the desired outcome and helping cope with the occasional set-backs.

Much of the success of JIT lies in the ability to develop renewed and lasting relationships within and external to the organization. This commitment and teambuilding does not occur without a great amount of effort and time. However, once people are aware of their personal stake in JIT, and an atmosphere

based on trust emerges, they will be more likely to contribute to a successful program.

C. RECOMMENDATIONS FOR FURTHER STUDY

This following are recommendations of further study once the prime vendor program is initiated:

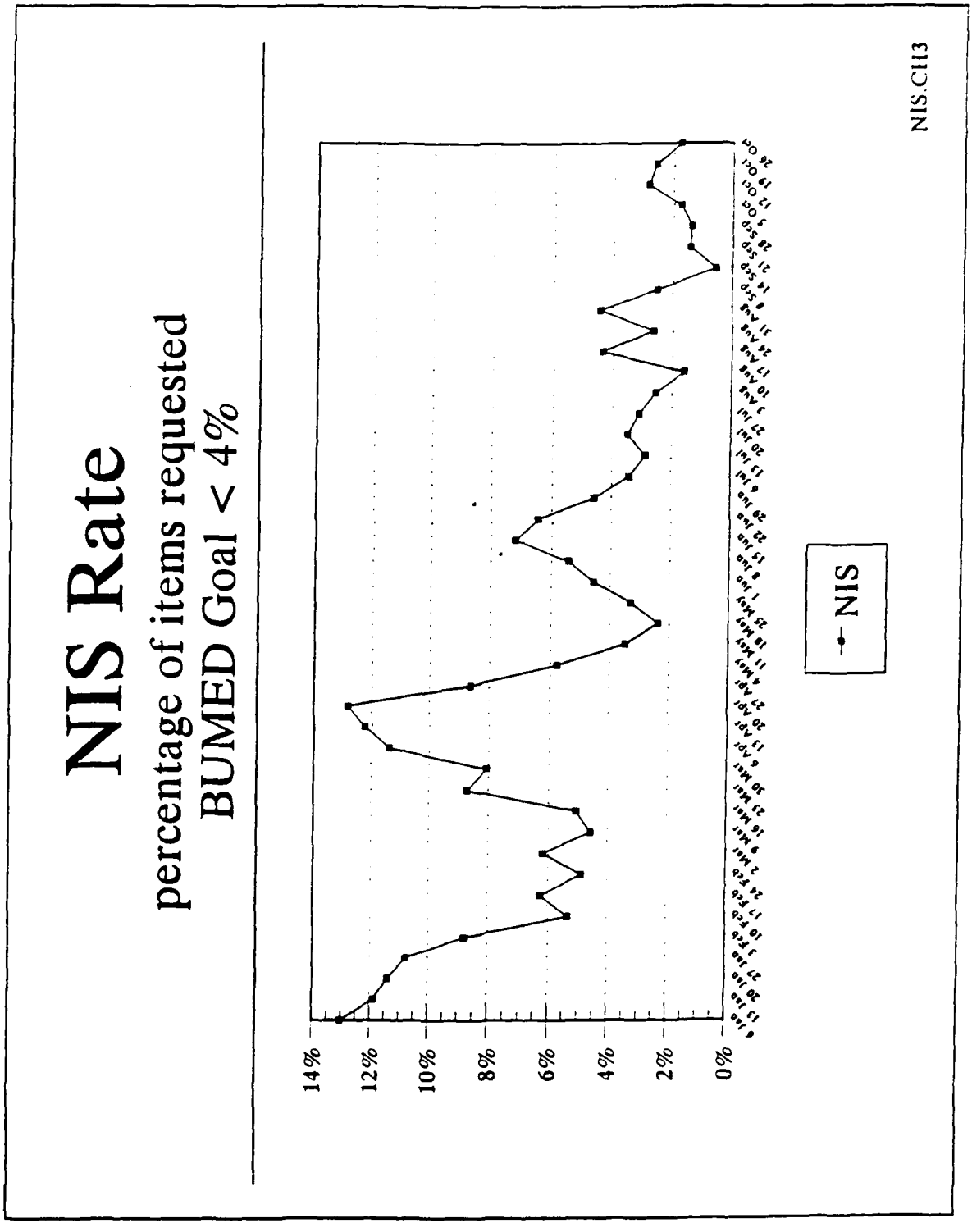
1. Analyze prime vendor contracting specifications to determine if they provide for maximum results.

2. Using established inventory management measures of effectiveness, determine if the prime vendor program and other JIT techniques have attained program objectives.

3. Analyze the prime vendor information system and its effectiveness in interfacing with other materials management reporting systems.

4. Determine the impact of FAR regulations on the effectiveness of the prime vendor program.

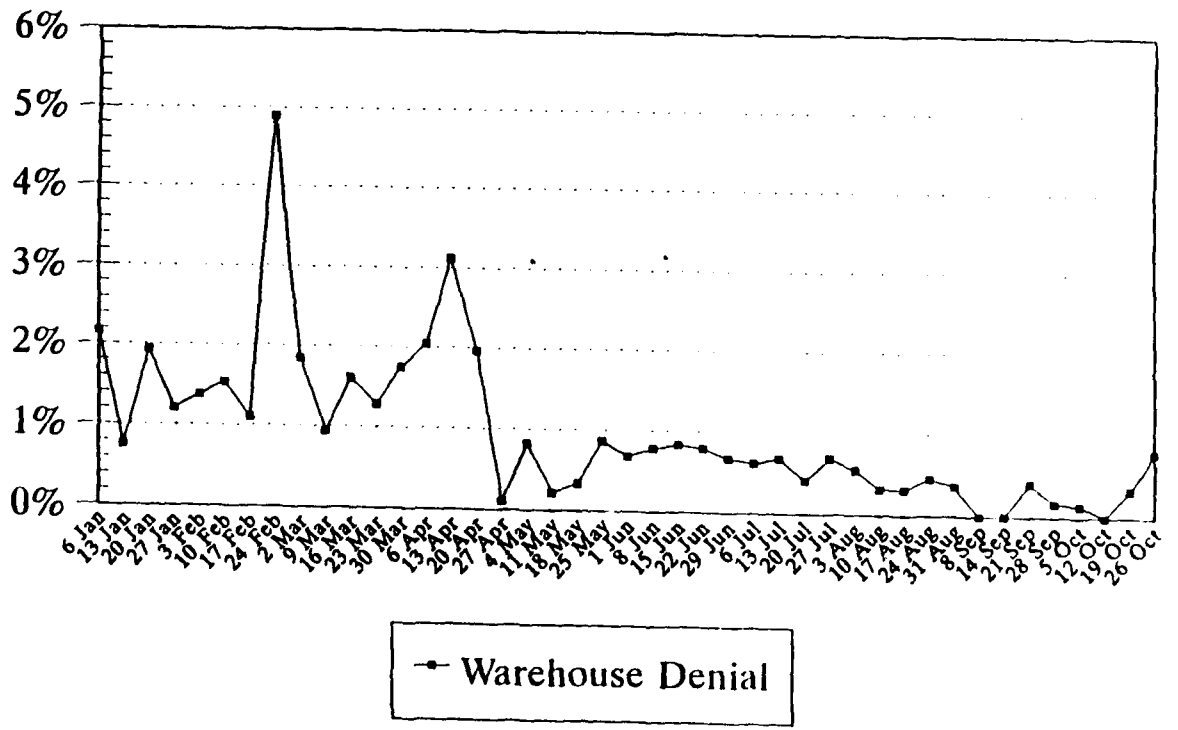
APPENDIX A.
MATERIAL MANAGEMENT MEASURES OF EFFECTIVENESS



Warehouse Denial Rate

Weekly Rate

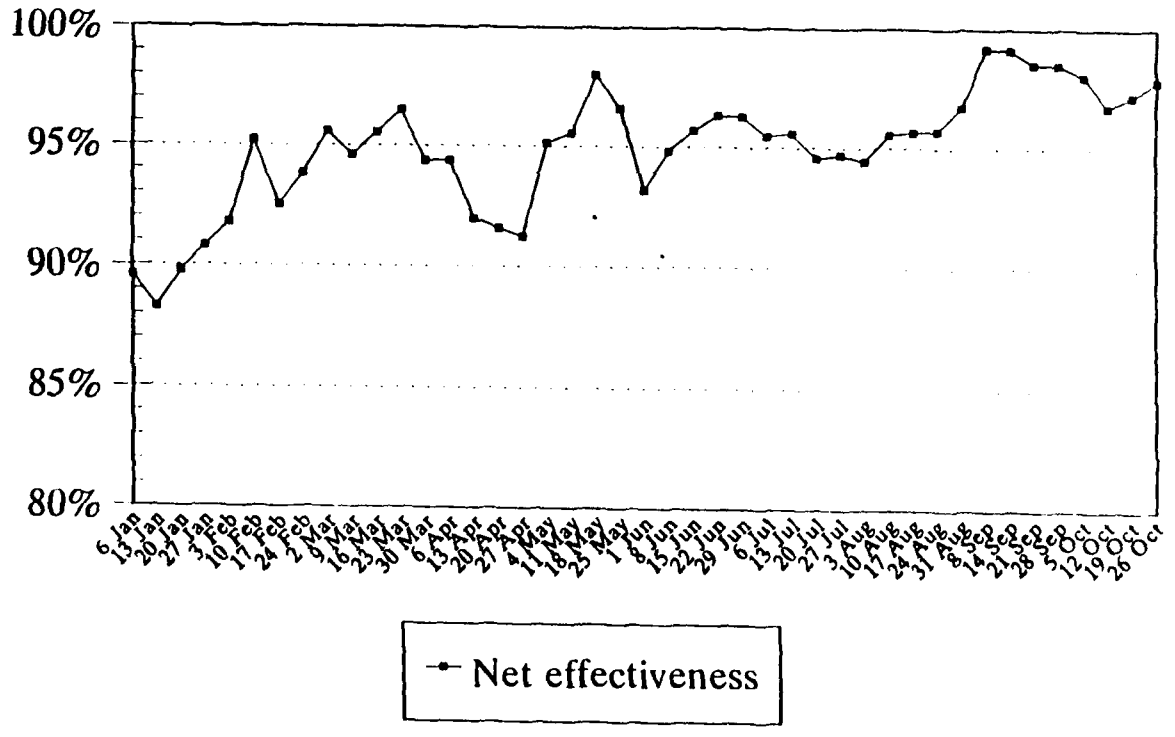
BUMED Goal < 1%



WD.CH3

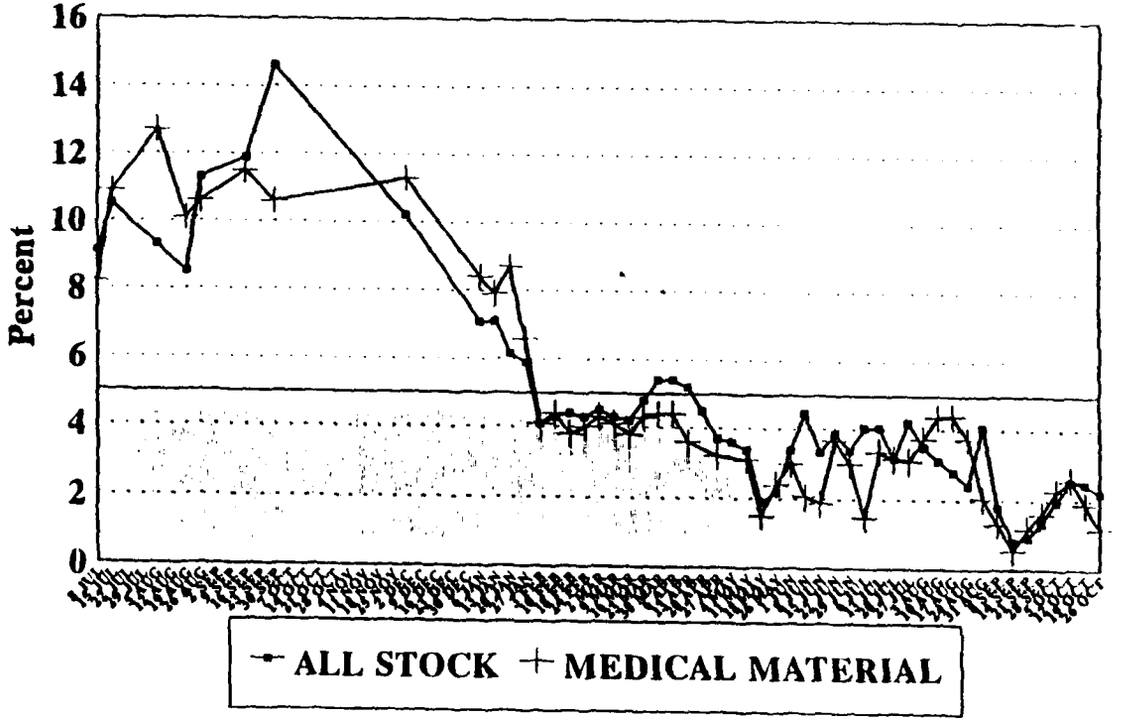
Net Effectiveness

Weekly Average Net Effectiveness
BUMED Goal > 85%



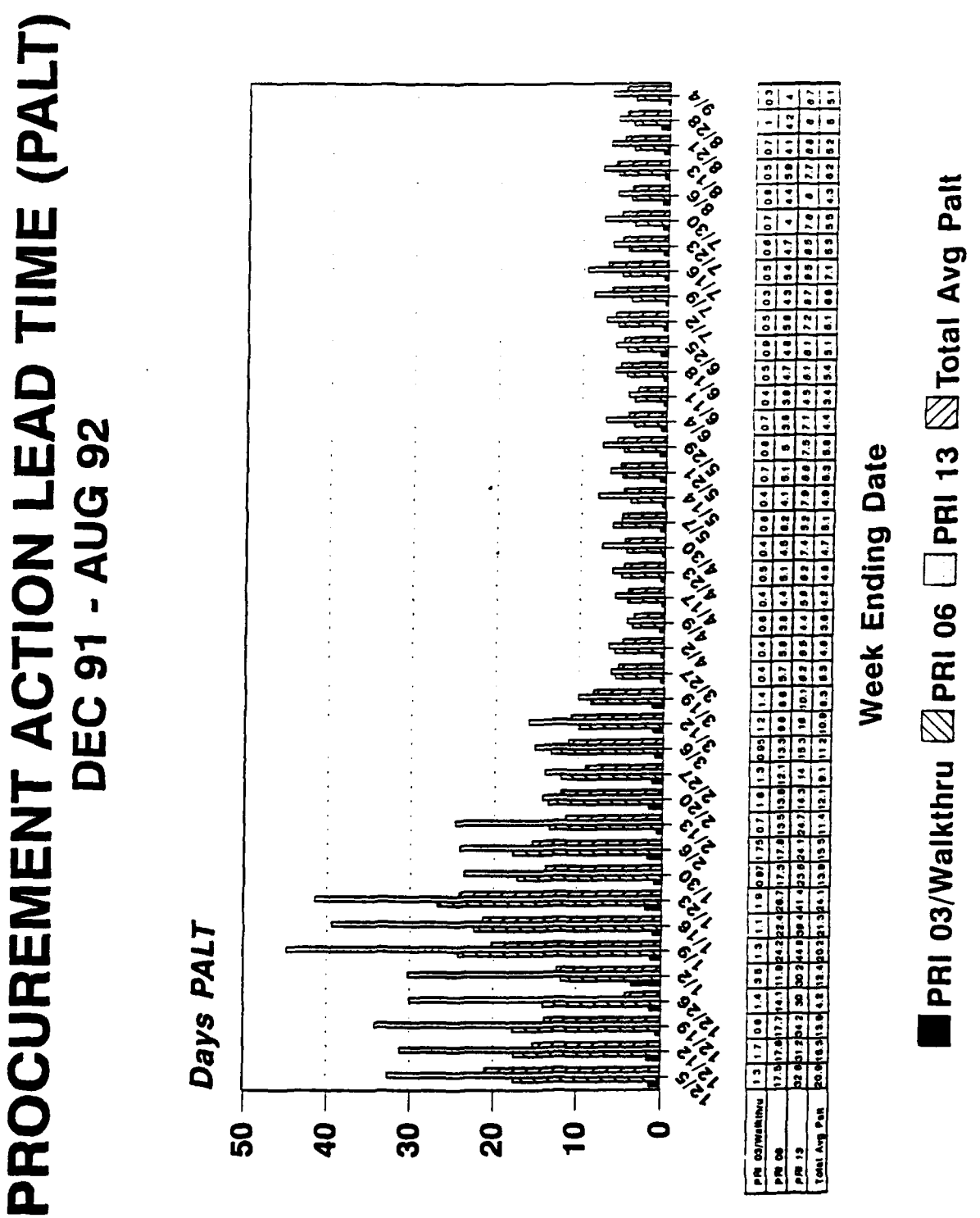
NET_EFCT.CH3

Zero Balance in the Warehouse
BUMED Goal <5%

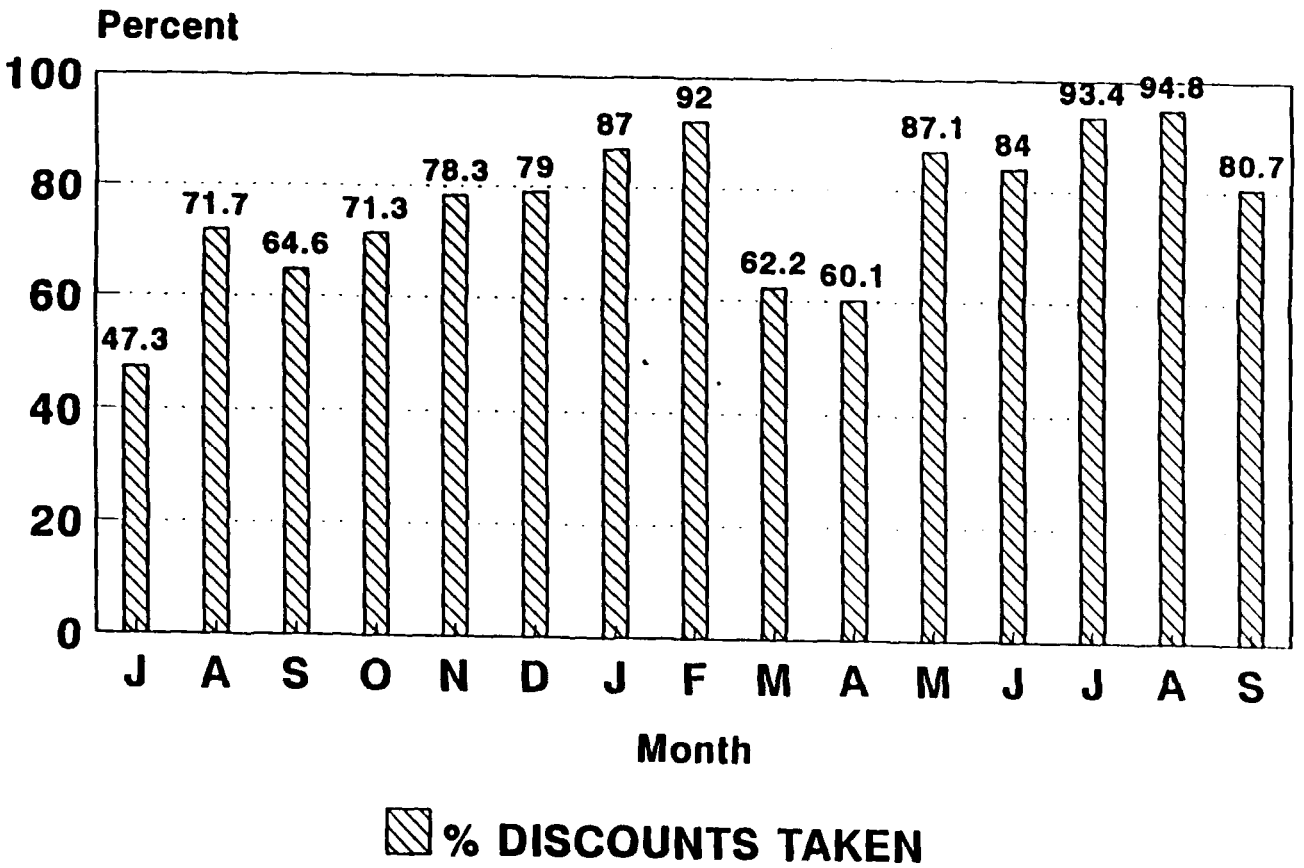


LONGTREN.CH3

APPENDIX B.
CONTRACTING DEPARTMENT MEASURES OF EFFECTIVENESS

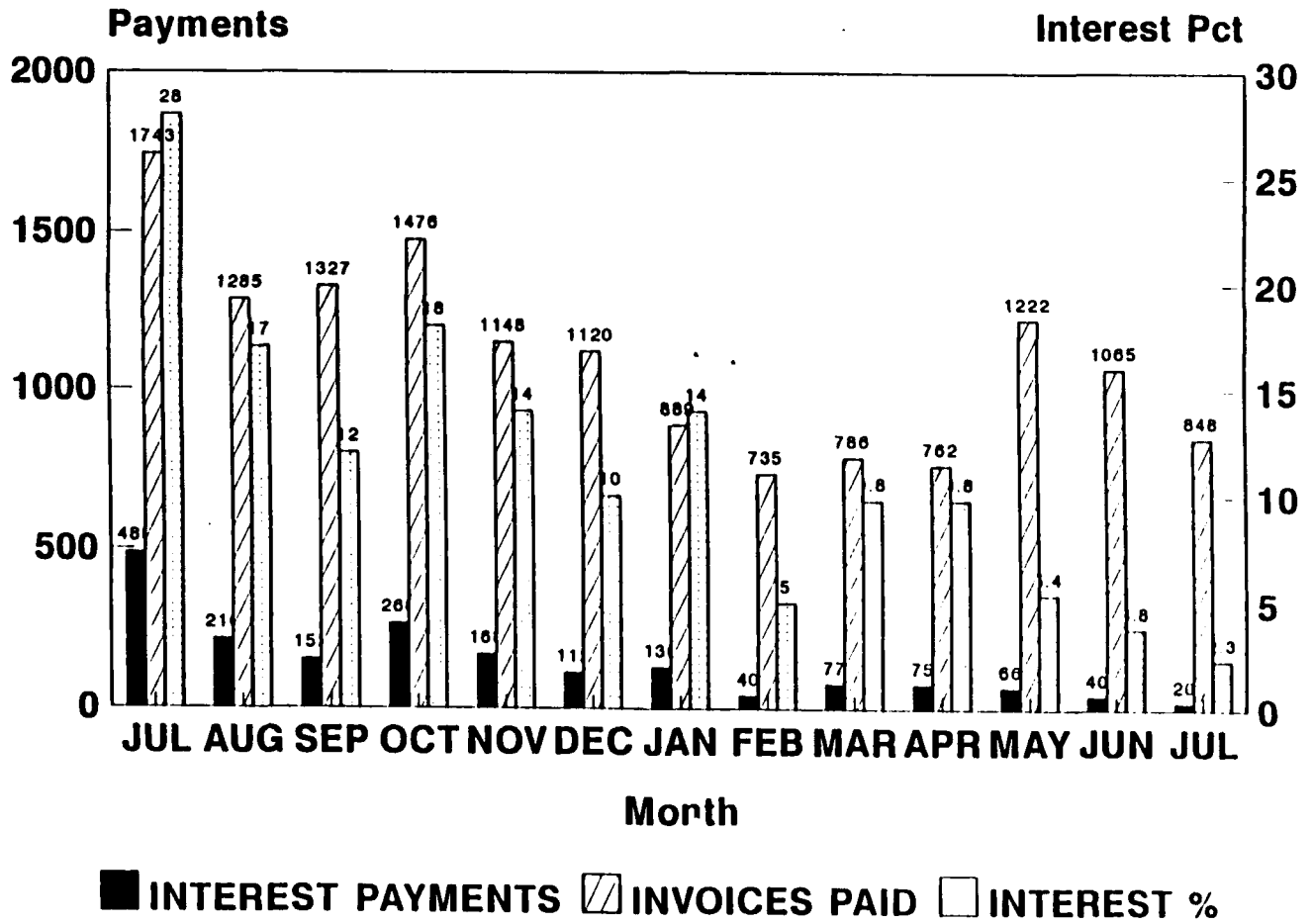


DISCOUNTS TAKEN (%)
FY 91 (Jul - Sep) / FY 92 to date

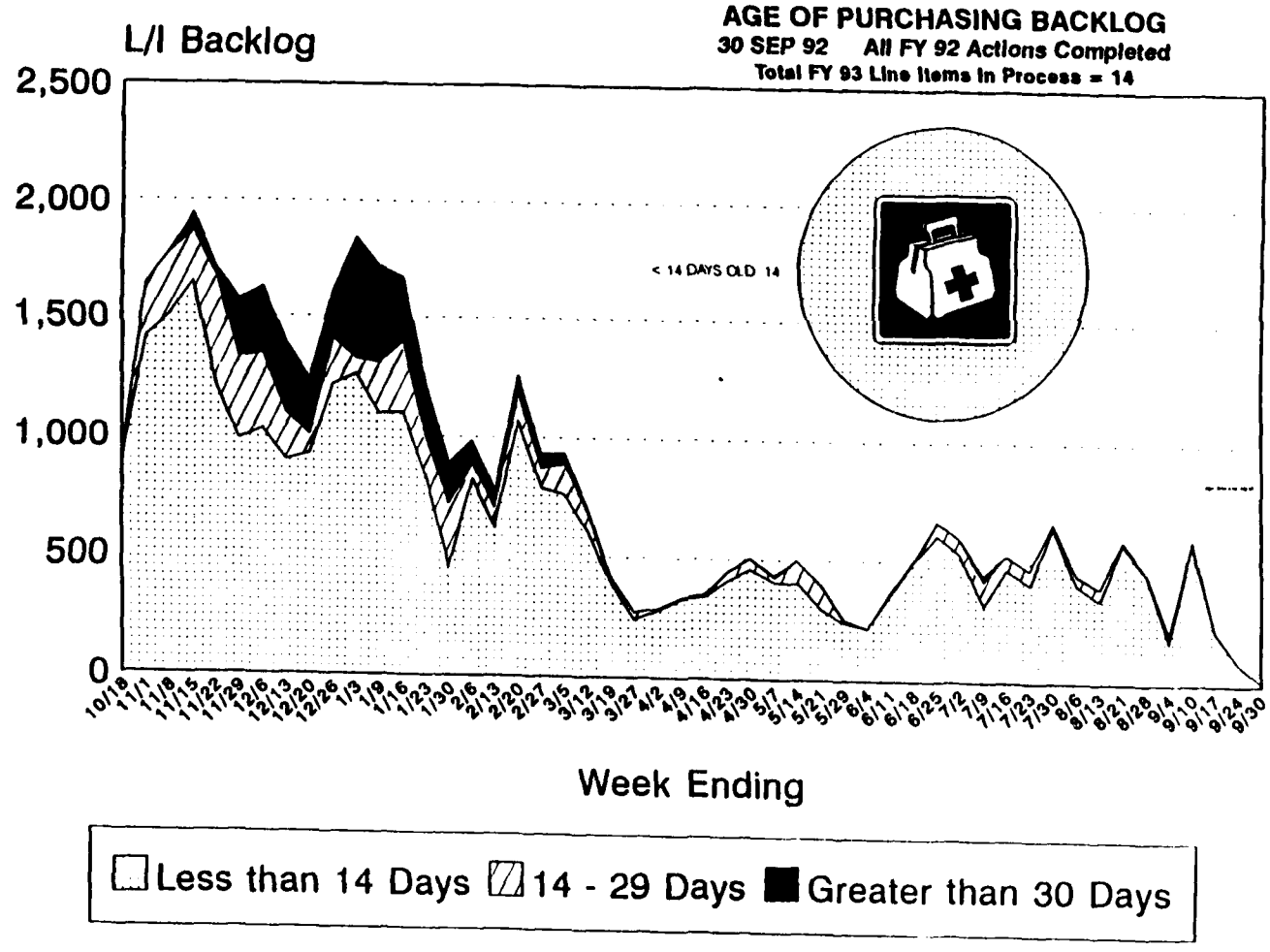


RATIO OF DISCOUNTS TAKEN TO OFFERRED
FOR PROMPT PAYMENT OF INVOICES

INTEREST PAYMENTS
VS TOTAL INVOICES PAID



Age of Purchasing Line Item Backlog
FY 92 Final 30 Sep 92



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